

HDO and D₂O low pressure, long path spectra in the 600 to 3100 cm⁻¹ region. II. D₂O line positions and strengths.

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Abstract

Measurements of line positions and absolute strengths of D_2O from 700 to 3100 cm^{-1} were obtained with a Fourier transform spectrometer. The data were analyzed to obtain energy levels of the (000), (010), (020), (100), and (001) vibrational states of $D_2^{16}\text{O}$ and, first time assignments of the (010)-(000) band of $D_2^{17}\text{O}$, including the energy levels of the (000) and (010) states. The measurements included transitions of the (010)-(000) band of $D_2^{18}\text{O}$ however observations from a previous study provided adequate information for the energy levels. The measured line strengths of the (010)-(000) bands of $D_2^{16}\text{O}$, $D_2^{17}\text{O}$, and $D_2^{18}\text{O}$ were fitted to model which included up to 19 dipole moment expansion coefficients. The observed line strengths of the $D_2^{16}\text{O}$ interacting bands, (020)-(010), (100)-(010), and (001)-(010), were analyzed using a full perturbation treatment.

1. INTRODUCTION

This study follows the previous one (1) involving HDO measurements which includes the experimental conditions of the HDO/D₂O measurements and the methods used to obtain the observed line positions and strengths from the data. The present study is a continuation of an earlier work (2) covering measurements and analysis of the v_2 bands of D₂¹⁶O and D₂¹⁸O. Several of the measurements given here are presented for the first time which includes the following: line positions and strengths of the (010)-(000) bands of D₂¹⁷O, and the "hot" bands, (020)-(010), (100)-(010), and (001)-(010), of D₂¹⁶O. Also included and previously not reported are measurements and assignments of high J and/or high K_a transitions of the (010)-(000) band of D₂¹⁶O. Other data include line position measurements of the (020)-(000), (100)-(000), and (001)-(000) bands of D₂¹⁶O in the 2198 to 3100 cm⁻¹ region and these frequencies along with the line positions of the "hot" bands were used in the analysis to obtain the upper state rotational energy levels. Papineau et al. (3) analyzed three spectra of D₂¹⁶O between 2170 and 3090 cm⁻¹ and obtained a set of rotational levels belonging to the (020), (100), and (001) vibrational states. These values, along with energy levels of the (000) and (010) states from my earlier work (2), were used in the present investigation for computing transition frequencies of bands involving the three upper states. In turn, the calculated positions were used to assign the majority of the absorptions of these bands observed in the present set of data.

2. SPECTRAL ANALYSIS AND ENERGY LEVELS

A non-linear least-squares interactive computer program was used in the analysis of the data and the procedure for using the program was described in the previous report (1) which included the methods used to derive measured values of line positions and strengths of HDO, D₂O and H₂O from the spectra. Frequency calibration standards used in the previous report (1) was used in the present study for the 600 to 2000 cm⁻¹ region. Frequency calibration for the (020)-(000) band region (2190-2500 cm⁻¹) was established from several well-measured transitions in the (020)-(010) band with J < 9 which were used to determine a preliminary set of upper state, (020), levels using values of the (010) state rotational levels given in ref. (2). These upper state values were then used to compute transitions in the (020)-(000) band with lower state, (000), energy levels also given in ref. (2). The higher region (2500-3100 cm⁻¹) calibration was established from HDO lines used for that region in the previous report (1).

The majority of the observed lines assigned to the v₂ band of D₂¹⁶O were derived from the information given in ref. (2) whereas new assignments for the higher J and/or K_a transitions were identified in the spectra by comparing computed and observed positions and in some cases, line strengths. Several of the energy level values included in the computations were previously unknown and approximate line frequencies for those were derived from the calculations. The D₂¹⁷O assignments were derived only from the present set of spectra and the procedure included computations

using approximate values for the frequency parameters for both the (000) and (010) states. The transition frequencies derived from the computed energy levels were used to assign $D_2^{17}O$ lines observed in the spectra. The optical paths of $D_2^{18}O$ in the spectra were comparable to those of the shorter path length, O^{18} enriched samples used in the earlier study (2). Therefore the present set of data did not provide any new information on $D_2^{18}O$ frequencies. However the absolute concentrations of $D_2^{18}O$ were more accurately known for the samples used in the present experiment than those of the earlier study (2) and line strength values of $D_2^{18}O$ obtained in the present work were analyzed to obtain dipole moment parameters for the (010)-(000) band.

The majority of the assignments for transitions of the (020)-(010), (100)-(010), (001)-(010), (020)-(000), (100)-(000), and (001)-(000) bands of $D_2^{16}O$ observed in the spectra were derived from the comparison of measured and computed line positions. The calculated frequencies were determined from energy level values given by Papineau et al. (3) for the upper states and lower state levels given in ref. (2). Assignments for transitions involving levels of the (020) state not listed in ref. (3) were located in the spectra from analysis of the (020)-(010) band. The method was based on approximate values of computed line positions using parameters of the (020) state given by Papineau et al. (3).

Rotational energy levels for the (000) state of $D_2^{16}O$ for the higher levels were derived from measurements of the (010)-(000) band using the method of combination difference frequencies (CDF's)

which was described in the previous report (1). The higher levels include a few high K_a levels for $9 < J < 18$ and all levels with $J > 17$. The lower energy level values were found to be accurately given in ref. (2). The ground state for $D_2^{17}O$ were determined from the measurements in the (010)-(000) band with the lowest rotational levels; 1 1 0, 1 1 1, and 1 0 1, initially given approximate values. The lowest levels with approximate values were combined with the CDF's for $J < 4$ in a fitting procedure using the Hamiltonian due to Watson (4). The procedure was repeated to insure accurate computed values for the lowest levels. The remainder of the ground state level values of $D_2^{17}O$ were determined from the CDF's of the present measurements.

After the ground state term values and associated estimated uncertainties were obtained for $D_2^{16}O$ and $D_2^{17}O$, the rotational energies in the (010) state were derived by adding to each measured transition frequency of the (010)-(000) band, the appropriate lower state energy level. Included in this analysis were measurements obtained in the earlier study (2) for $D_2^{16}O$ lines with strengths $\geq 0.001 \text{ cm}^{-2}/\text{atm}$. (normalized to 100% of the sample for D_2O). The results for both isotopic species were weighted and then averaged for each level. The same procedure was followed for deriving values of the levels for the (100) and (001) states of $D_2^{16}O$ using measurements in the (100)-(000) and (001)-(000) bands, respectively. The (020) state levels were obtained by this procedure from observed line positions in the (020)-(010) band using levels of the (010) state that were derived in this study.

During this work it was found that, for a given rotational transition, the strength of the line in the (020)-(010) band was almost twice that of the transition line in the (020)-(000) band for both cases at a sample temperature of 296K. Further, absorptions in the (020)-(000) band were hindered in the spectra due to interference from lines in the v_3 of CO₂ as a result of a slight amount of CO₂ in the vacuum tank which enclosed the FTS. Therefore, the most accurate results for the (020) state were derived from an analysis of the (020)-(010) band.

Table 1 is a listing of the rotational energy levels obtained in this study for the (000), (010), (020), (100), and (001) vibrational states of D₂¹⁶O. Also included are associated, estimated uncertainties given within parentheses after the term values. The majority of the values for the ground state were given in my earlier work (2) and are repeated in the table. All other values given in the table were determined in this study. Table 2 is a listing of the energy level values for the (000) and (010) states of D₂¹⁷O and Table 3 lists the vibration-rotation parameters obtained from a least-squares fit of the (000) state of D₂¹⁷O and the values given within parentheses reflect the uncertainties in the last digits of the parameters and apply only for computing term values for J ≤ 7. Energy level values given in Tables 1 and 2 with uncertainties of 0.003 cm⁻¹ or greater may be in error by as much as ± 0.02 cm⁻¹.

3. LINE STRENGTHS

The expression used for the strength, S , of an HDO transition given in eq. (2) in the previous report (1) is the same as that used in the present study for a D_2O line with non-interacting effects. The experimental line strengths of the ground state bands of the various isotopic species of D_2O were analyzed using this expression. The method is based on fitting the measurements to a model of the dipole moment represented by 19 or less expansion coefficients for B-type transitions. The expressions for the matrix elements used in the expanded dipole are listed in Table 3 in the previous report (1).

The line strengths of the interacting $D_2^{16}O$ bands; $(020)-(010)$, $(100)-(010)$, and $(001)-(010)$, were analyzed using perturbation theory by the same method used by this author in the analysis of the $H_2^{16}O$ "hot" bands (5); $(020)-(010)$, $(100)-(010)$, and $(001)-(010)$. In brief, the vibration-rotation dipole moment element, $R(L,U)$, for either the $(020)-(010)$ or $(100)-(010)$ bands can be expressed as:

$$R(L,U) = \sum_j u(Sf,j)x(Sf,j) + \sum_j u(F,j)x(F,j) + \sum_{j'} u(C,j')x(C,j')$$
$$R(L,U) = \quad s^f R(L,U) \quad + \quad ^F R(L,U) \quad + \quad ^C R(L,U), \quad (1)$$

were Sf means self, F means Fermi, and C means Coriolis. The Fermi-type interactions are between the (020) and (100) states and the Coriolis type interactions are between the (020) and (001) states as well as between the (100) and (001) states. $R(L,U)$ for

the (001)-(010) band takes on a somewhat different form:

$$R(L, U) = \sum_j u(Sf, j)x(Sf, j) + \sum_{j'} u(C_1, j')x(C_1, j') + \sum_{j'} u(C_2, j')x(C_2, j')$$
$$R(L, U) = s^f R(L, U) + c^1 R(L, U) + c^2 R(L, U), \quad (2)$$

where C_1 and C_2 represent Coriolis-type interactions between the (001) and (100) states and between the (001) and (020) states, respectively.

The rotational wavefunctions are expressed as a linear combination of symmetry-adapted wavefunctions and the mixing coefficients of the wavefunctions were derived from the solution of the orthogonal H-matrix:

$$H = \begin{array}{ccc} H[Sf]_{11} & H[F]_{12} & H[C]_{13} \\ H[F]_{21} & H[Sf]_{22} & H[C]_{23} \\ H[C]_{31} & H[C]_{32} & H[Sf]_{33} \end{array} \quad (3)$$

where the subscripts, 1, 2, and 3, of the sub-matrices represent the vibrational states (020) or (100), (100) or (020), and (001), respectively. and Sf, F, and C denote self, Fermi, and Coriolis.

Vibration-rotation frequency parameters obtained in other studies were applied here for the determination of the wavefunction mixing coefficients. These included the following: the ground

state parameters of $D_2^{16}O$ from Toth (2), those of the (010) state of $D_2^{16}O$ from Camy-Peyret et al. (6), and the parameters given by Papineau et al. (3) for the (020), (100), and (001) states of $D_2^{16}O$. The wavefunction mixing coefficients for transitions of the (010)-(000) bands of $D_2^{17}O$ and $D_2^{18}O$ were derived from the $D_2^{16}O$ parameters which is an accurate approximation. Papineau et al. (3) from a fit of experimental line frequencies in the (020)-(000), (100)-(000), and (001)-(000) bands, solved the H-matrix shown above in eq. (3) and obtained, in addition to the "unperturbed" parameters, the Fermi- and Coriolis-type parameters for the (020), (100), and (001) vibrational states.

The measured line strengths of the ground state bands were least-squares fitted using the expression given in eqs. (2), the dipole moment elements given in Table 3 of ref. (1), and the energy level values given in Tables 1 and 2 of the present study. The measured strengths analyzed in this study were normalized to 99.9% of the sample for each isotopic species. The observed line strengths of the interacting bands were fitted simultaneously using the methods described in ref. (5) along with the energy levels given in Table 1 and the dipole matrix elements given in Tables 3 and 4 in refs. (1) and (5).

The dipole moment expansion coefficients derived from the least-squares fit of the measured line strengths are listed in Table 4. The number of lines fitted, N, and given below the dipole moment coefficients in Table 4 are not all of the lines measured. The strengths of the lines included in each analysis were measured

to good accuracy with estimated uncertainties of 6% or less. The standard deviation in percent, $\sigma\%$, given below each set of results were derived from the expression:

$$\sigma\% = \{\sum [(S_{obs} - S_{cal})/S_{obs}]^2/N\}^{1/2} \times 100. \quad (4)$$

Inspection of the table shows that the results for the (010)-(000) band of $D_2^{16}O$ are given in terms of sets with each set representing a frequency interval. The same was also found in my recent work on the (010)-(000) band of $HD^{16}O$ (1) in which the theory in the present state is not adequate to take care of all the necessary measurements in one fitting procedure. However one fit was adequate in the analysis of the line strengths measured in my earlier D_2O study (2) because the theory can account for all of the stronger transitions. The addition of the weaker transitions in the present study made the above requirement (separating the measurements into sets) necessary.

It was not necessary to separate the data into frequency intervals for fitting the (010)-(000) bands of $H_2^{18}O$ and $H_2^{17}O$ and the "hot" bands because the range of line strength values were within the range (all strength values within about 3 to 4 orders of magnitude of each other) for the theory to operate sufficiently well with all measurements included in one fitting procedure. However another problem existed in the fitting process of the interacting bands which involved relative signs of the transition moment constants, $u(n,j)$. Several sign combinations were tried and

the one combination which was found to be better than the rest was for the leading term, $j=1$ (see Table 4), of the (020)-(010) band to be opposite in sign to those of the (100)-(010) and (001)-(010) bands and the convention used here was - + + for the signs of $j=1$ terms of the (020)-(010), (100)-(010), and (001)-(010) bands, respectively. This was the same result found for the interacting "hot" bands of H_2^{16}O (5).

4. RESULTS

The listing for the (010)-(000) band of D_2^{16}O contains over 1300 lines (several of which are doubled transitions) and the complete list is not given here and will be presented in a forthcoming paper involving D_2O and HDO broadening parameters. Also the listing for the (010)-(000) of D_2^{18}O is not given in this presentation because the listing given in my earlier work (2) shows minimal differences. However results for the (010)-(000) band of D_2^{17}O have not been reported in literature and a listing is provided in Table 5. The table gives observed line positions, observed minus computed (o-c) positions, rotational quantum assignments, observed strengths estimated uncertainties in the strengths, %s, the computed strength, and the difference between the observed and computed strength in percent, (o-c)%. An asterisk next to the line position entry denotes a doubled absorption consisting of two transitions which were not adequately resolved in the spectra. The quantum assignments for these entries represent the stronger of the two comparable transitions and the strength pertains to the sum of

the two strengths. The computed positions were derived from the energy level values given in Table 2 and the computed strengths were calculated using eq. (2) from ref. (1) and the dipole moment expansion coefficients given in Table 4. The line strengths given in the table were normalized to 99.9% D₂¹⁶O with 0.0373% D₂¹⁷O.

The computed line strengths of a transition of one of the interacting bands can be expressed as:

$$S = [\rho(n,1)/S(n,1) + \rho(n,2)/S(n,2) + \rho(n,3)/S(n,3)]^2$$

$$S = [Z_1 + Z_2 + Z_3]^2$$

$$\text{where } \rho(n,m) = {}^{n,m}R(L,U) / |{}^{n,m}R(L,U)|, \quad (5)$$

where ${}^{n,m}R(L,U)$ and $S(n,m)$ are the dipole moment matrix element and computed strength due to the interaction between states n and m. If there are no interactions, eq. (5) reduces to eq. (2) in ref. (1). $S(n,m)$ expressed in terms of the three Z's in eq. (5) simply refers to the un-perturbed contributions from the three interacting bands.

Table 6 is a listing of measurements and computed values for the (020)-(010) band given in a similar format to that of Table 5 with the addition of values of Z₁, Z₂, and Z₃, defined in eq. (5) and given in the last three columns of the table. Z₁ refers to no interactions whereas Z₂ and Z₃ pertains to contributions from the interactions due to the (100)-(010) and (001)-(010) bands, respectively. The table includes computed line positions derived

from the energy levels of the (010) and (020) states given in Table 1. The computed strengths were derived from the expressions given in this study and also in ref. (5) and the dipole moment expansion coefficients given in Table 4. Tables 7 and 8 are similar listings for the (100)-(010) and (001)-(010) bands, respectively.

5. CONCLUSION

This study involves the analysis of over 2000 measured line positions and strengths of $D_2^{16}O$, $D_2^{17}O$, and $D_2^{18}O$ involving absorption path lengths up to and including 433m. This work is an extension of my earlier study (2) on D_2O in which path lengths did not exceed 2.39m. The line frequencies were analyzed to obtain experimental values of energy levels of the (000), (010), (020), (100), and (001) vibrational states of $D_2^{16}O$ and the (010) and (000) states of $D_2^{17}O$. The optical paths of $D_2^{18}O$ in the spectra were comparable to those of the shorter path length, O^{18} enriched samples used in the earlier study (2). Therefore the present set of data did not provide any new information on $D_2^{18}O$ frequencies. The measurements covered the 600 to 3100 cm^{-1} region. The higher region included transitions of the (020)-(000), (100)-(000), and (001)-(000) bands of $D_2^{16}O$ and these measurements were only used in the line frequency analysis. The line strengths were analyzed using the techniques outlined in the previous papers on HDO (1) and $H_2^{16}O$ (5). The line strengths of the "hot" bands: (020)-(010), (100)-(010), and (001)-(010), were analyzed using a full perturbation treatment. The leading terms of the dipole moment expansion coefficients were

found to be -0.1625 Debye, 3.40×10^{-2} Debye, and 1.785×10^{-2} Debye for the $(020)-(010)$, $(100)-(010)$, and $(001)-(010)$ bands, respectively.

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Table 1. Rotational energy levels (cm^{-1}) of $D_2^{16}\text{O}$ for the (000), (010), (020), (100), and (001) vibrational states.

$J\ K_a\ k_c$	(000)	(010)	(020)	(100)	(001)	$J\ K_a\ k_c$
0 0 0		1178.37896(4.)	2336.83897(6.)	2671.64530(50.)	2787.71824(10.)	0 0 0
1 0 1	12.117020(0.3)	1190.50603(2.)	2348.97090(5.)	2683.60534(10.)	2799.75852(5.)	1 0 1
1 1 1	20.258998(0.3)	1199.79303(3.)	2359.68949(5.)	2691.60642(10.)	2807.39347(3.)	1 1 1
1 1 0	22.684325(0.3)	1202.33799(3.)	2362.34755(4.)	2694.01091(10.)	2809.84252(7.)	1 1 0
2 0 2	35.878022(0.5)	1214.29716(2.)	2372.79062(3.)	2707.05242(10.)	2823.33067(10.)	2 0 2
2 1 2	42.069313(0.3)	1221.50506(2.)	2381.29973(6.)	2713.12096(6.)	2829.02925(4.)	2 1 2
2 1 1	49.339396(0.5)	1229.13332(2.)	2389.26677(2.)	2720.32899(7.)	2836.37007(4.)	2 1 1
2 2 1	73.676398(0.3)	1256.85453(5.)	2421.19495(4.)	2744.24538(5.)	2859.19445(14.)	2 2 1
2 2 0	74.142003(0.5)	1257.30931(3.)	2421.63047(5.)	2744.70982(10.)	2859.69518(6.)	2 2 0
3 0 3	70.447535(0.3)	1248.92323(3.)	2407.49000(4.)	2741.15405(20.)	2857.55206(12.)	3 0 3
3 1 3	74.506235(0.5)	1253.79905(5.)	2413.45063(4.)	2745.11606(15.)	2861.18490(12.)	3 1 3
3 1 2	88.971361(0.3)	1268.98398(3.)	2429.31734(5.)	2759.45654(12.)	2875.78120(5.)	3 1 2
3 2 2	110.034055(0.5)	1293.24881(3.)	2457.61282(3.)	2780.12171(7.)	2895.33877(8.)	3 2 2
3 2 1	112.251557(0.5)	1295.42642(2.)	2459.70997(5.)	2782.33231(10.)	2897.70816(14.)	3 2 1
3 3 1	156.60555(3.)	1345.58487(2.)	2516.95275(7.)	2825.94692(13.)	2939.48606(7.)	3 3 1
3 3 0	156.66288(4.)	1345.63702(3.)	2516.99843(5.)	2826.00470(25.)	2939.55227(6.)	3 3 0
4 0 4	114.98654(1.)	1293.51251(3.)	2452.17778(3.)	2785.07738(9.)	2901.57997(4.)	4 0 4
4 1 4	117.312071(0.5)	1296.41707(3.)	2455.88800(5.)	2787.33553(10.)	2903.58966(21.)	4 1 4
4 1 3	141.086956(0.5)	1321.41353(3.)	2482.04845(3.)	2810.90115(10.)	2927.53295(4.)	4 1 3
4 2 3	158.111106(2.)	1341.38190(4.)	2505.79140(3.)	2827.56058(8.)	2943.10036(12.)	4 2 3
4 2 2	164.17772(1.)	1347.39332(3.)	2511.63768(3.)	2833.60351(8.)	2949.52054(5.)	4 2 2
4 3 2	205.88637(3.)	1394.91461(3.)	2566.30317(10.)	2874.55703(10.)	2988.57341(5.)	4 3 2
4 3 1	206.27662(2.)	1395.26985(3.)	2566.61574(3.)	2874.95152(4.)	2989.01868(7.)	4 3 1
4 4 1	269.37544(2.)	1466.15415(8.)	2646.84320(20.)	2937.03623(10.)	3048.62340(20.)	4 4 1
4 4 0	269.38132(5.)	1466.15925(4.)	2646.84706(5.)	2937.03677(10.)	3048.63063(10.)	4 4 0
5 0 5	169.03860(1.)	1347.54078(4.)	2506.25777(9.)	2838.37489(10.)	2955.00948(15.)	5 0 5
5 1 5	170.24301(1.)	1349.10907(2.)	2508.35910(4.)	2839.53675(10.)	2955.99592(25.)	5 1 5
5 1 4	204.93764(3.)	1385.70093(6.)	2546.78050(5.)	2873.91426(6.)	2990.78173(2.)	5 1 4
5 2 4	217.58560(2.)	1400.93686(4.)	2565.42374(3.)	2886.24255(12.)	3002.13550(7.)	5 2 4
5 2 3	229.99204(2.)	1413.35657(6.)	2577.64539(4.)	2898.58666(15.)	3015.13010(20.)	5 2 3
5 3 3	267.53067(3.)	1456.63126(2.)	2628.05618(4.)	2935.35516(27.)	3049.95429(16.)	5 3 3
5 3 2	269.01031(5.)	1457.98592(3.)	2629.25468(7.)	2936.85616(7.)	3051.62689(7.)	5 3 2
5 4 2	331.07206(3.)	1527.91698(8.)	2708.63960(8.)	2997.89334(10.)	3110.21699(7.)	5 4 2
5 4 1	331.12385(3.)	1527.96078(9.)	2708.67512(6.)	2997.89384(6.)	3110.27962(15.)	5 4 1
5 5 1	411.54193(6.)	1617.84328(3.)	2809.72312(20.)	3077.01028(80.)	3186.22250(60.)	5 5 1
5 5 0	411.54235(5.)	1617.84377(10.)	2809.72320(7.)	3077.01028(80.)	3186.22352(40.)	5 5 0
6 0 6	232.52186(3.)	1410.87787(4.)	2569.53495(4.)	2900.96975(6.)	3017.85514(7.)	6 0 6
6 1 6	233.10584(3.)	1411.67085(5.)	2570.65010(4.)	2901.52909(10.)	3018.21827(7.)	6 1 6
6 1 5	279.56485(4.)	1460.90317(3.)	2622.60968(5.)	2947.53857(25.)	3064.45955(8.)	6 1 5
6 2 5	288.09397(5.)	1471.55199(6.)	2636.15667(4.)	2955.80636(8.)	3072.06240(8.)	6 2 5
6 2 4	309.26526(2.)	1492.95103(8.)	2657.45550(4.)	2976.84244(7.)	3094.02544(5.)	6 2 4
6 3 4	341.38896(7.)	1530.60166(5.)	2702.09803(6.)	3008.13211(15.)	3123.45154(3.)	6 3 4
6 3 3	345.44697(4.)	1534.35551(4.)	2705.45475(8.)	3012.30065(18.)	3127.97477(8.)	6 3 3
6 4 3	405.28358(4.)	1602.20254(6.)	2782.95508(5.)	3071.20523(5.)	3184.28275(9.)	6 4 3
6 4 2	405.53196(3.)	1602.41367(5.)	2783.12618(5.)	3071.25219(5.)	3184.57914(15.)	6 4 2
6 5 2	485.59416(3.)	1691.99692(21.)	2883.94414(30.)	3149.87065(40.)	3260.68652(7.)	6 5 2
6 5 1	485.60009(5.)	1692.00164(7.)	2883.94765(15.)	3149.86809(10.)	3260.69362(40.)	6 5 1
6 6 1	582.40883(5.)	1799.65520(20.)	3004.15848(10.)	3244.87480(40.)	3351.65082(10.)	6 6 1
6 6 0	582.40888(4.)	1799.65520(20.)	3004.15848(10.)	3244.87480(40.)	3351.65082(10.)	6 6 0
7 0 7	305.49530(5.)	1483.57144(2.)	2642.03435(10.)	2972.92220(18.)	3089.26547(5.)	7 0 7
7 1 7	305.76698(4.)	1483.95630(3.)	2642.60215(7.)	2973.18068(13.)	3090.15893(19.)	7 1 7
7 1 6	364.04702(8.)	1546.05493(8.)	2708.55225(12.)	3030.86027(8.)	3147.73106(15.)	7 1 6
7 2 6	369.26637(2.)	1552.85410(4.)	2717.61935(10.)	3035.88418(8.)	3152.50594(5.)	7 2 6
7 2 5	401.26260(6.)	1585.48213(9.)	2750.43555(9.)	3067.60611(12.)	3185.39205(4.)	7 2 5
7 3 5	427.19898(3.)	1616.58138(4.)	2788.20865(8.)	3093.54515(40.)	3208.77168(15.)	7 3 5
7 3 4	436.06040(4.)	1624.90216(3.)	2795.76875(10.)	3101.74767(5.)	3218.48029(10.)	7 3 4
7 4 4	492.02187(4.)	1689.02985(9.)	2869.81381(12.)	3156.92291(15.)	3270.80872(5.)	7 4 4
7 4 3	492.88071(6.)	1689.76333(5.)	2870.41132(15.)	3157.38827(11.)	3271.81693(5.)	7 4 3
7 5 3	572.13069(4.)	1778.63747(4.)	2970.64448(8.)	3235.08350(40.)	3347.51155(20.)	7 5 3
7 5 2	572.16482(7.)	1778.66465(7.)	2970.66477(9.)	3235.07678(40.)	3347.55170(10.)	7 5 2
7 6 2	668.85185(11.)	1886.24678(11.)	3090.86355(10.)	3329.45770(20.)	3434.92480(60.)	7 6 2
7 6 1	668.85252(4.)	1886.24716(11.)	3090.86376(20.)	3329.45382(40.)	3434.92580(60.)	7 6 1
7 7 1	781.17236(5.)	2010.48540(8.)	3228.62736(10.)	3444.38668(110.)	3544.17036(10.)	7 7 1
7 7 0	781.17236(5.)	2010.48540(8.)	3228.62736(10.)	3444.38668(110.)	3544.17036(10.)	7 7 0
8 0 8	388.01890(4.)	1565.68876(9.)	2723.82659(7.)	3054.29205(7.)	3171.28559(10.)	8 0 8
8 1 8	388.14238(4.)	1565.87109(4.)	2724.10872(15.)	3054.40863(20.)	3172.67919(6.)	8 1 8
8 1 7	457.82327(4.)	1640.48532(6.)	2803.83083(10.)	3123.33200(9.)	3240.22033(10.)	8 1 7
8 2 7	460.76586(5.)	1644.49453(6.)	2809.45705(9.)	3126.14159(55.)	3243.15246(6.)	8 2 7
8 2 6	505.04911(4.)	1690.04997(6.)	2855.73970(15.)	3169.00300(5.)	3288.20451(19.)	8 2 6
8 3 6	524.60908(4.)	1714.23408(9.)	2886.07516(20.)	3189.25627(17.)	3305.54022(5.)	8 3 6

Table 1 continued

J	K _a	k _c	(000)	(010)	(020)	(100)	(001)	J	K _a	k _c
8	3	5	540.88188(5.)	1729.77875(3.)	2900.47452(6.)	3205.19013(10.)	3323.04996(4.)	8	3	5
8	4	5	591.21873(11.)	1788.34666(10.)	2969.17967(20.)	3254.87505(22.)	3369.69624(7.)	8	4	5
8	4	4	593.58712(3.)	1790.38693(5.)	2970.85603(8.)	3256.71699(15.)	3372.42613(8.)	8	4	4
8	5	4	671.19552(8.)	1877.80604(6.)	3069.85853(7.)	3332.75038(18.)	3446.72456(10.)	8	5	4
8	5	3	671.33602(7.)	1877.91785(7.)	3069.94251(10.)	3332.74795(33.)	3446.88214(5.)	8	5	3
8	6	3	767.71716(5.)	1985.26385(9.)	3189.98695(15.)	3426.41205(20.)	3531.22735(40.)	8	6	3
8	6	2	767.72132(6.)	1985.26704(5.)	3189.98920(7.)	3426.39098(16.)	3531.22880(100.)	8	6	2
8	7	2	880.05520(8.)	2109.57425(40.)	3327.87324(40.)	3544.01896(40.)	3641.39060(20.)	8	7	2
8	7	1	880.05525(8.)	2109.57425(10.)	3327.87324(40.)	3544.01750(100.)	3641.39060(20.)	8	7	1
8	8	1	1006.96238(10.)	2249.18136(3.)	3481.60158(3.)	3665.54489(38.)	3762.97698(18.)	8	8	1
8	8	0	1006.96238(10.)	2249.18136(3.)	3481.60158(3.)	3665.54489(38.)	3762.97698(18.)	8	8	0
9	0	9	480.12542(5.)	1657.27088(3.)	2814.96387(3.)	3145.11088(19.)	3262.43099(17.)	9	0	9
9	1	9	480.18058(3.)	1657.35604(8.)	2815.10202(5.)	3145.16234(10.)	3262.40545(13.)	9	1	9
9	1	8	560.75466(12.)	1743.95405(11.)	2908.07293(8.)	3224.82728(16.)	3341.83347(5.)	9	1	8
9	2	8	562.31726(6.)	1746.17988(9.)	2911.36075(8.)	3226.30477(20.)	3343.85260(3.)	9	2	8
9	2	7	619.56215(9.)	1805.60958(5.)	2972.36884(6.)	3283.29773(32.)	3401.32944(35.)	9	2	7
9	3	7	633.21680(8.)	1823.16510(11.)	2995.32077(7.)	3296.37393(15.)	3413.35102(4.)	9	3	7
9	3	6	659.41768(8.)	1848.61594(11.)	3019.36447(4.)	3322.00820(65.)	3441.06355(8.)	9	3	6
9	4	6	702.70241(6.)	1900.00527(8.)	3080.93180(15.)	3364.91315(15.)	3480.74270(12.)	9	4	6
9	4	5	708.17065(4.)	1904.78010(5.)	3084.90880(15.)	3369.73898(22.)	3486.91800(15.)	9	4	5
9	5	5	782.80928(4.)	1989.52442(8.)	3181.60718(8.)	3442.95506(62.)	3558.33055(7.)	9	5	5
9	5	4	783.26910(8.)	1989.89195(7.)	3181.88398(9.)	3443.04287(39.)	3558.83109(5.)	9	5	4
9	6	4	879.02855(10.)	2096.72392(6.)	3301.53750(6.)	3535.80632(37.)	3640.09835(45.)	9	6	4
9	6	3	879.04846(8.)	2096.73874(4.)	3301.54870(20.)	3535.72801(20.)	3640.11505(28.)	9	6	3
9	7	3	991.29712(10.)	2221.02628(7.)	3439.46700(50.)	3655.68631(8.)	3750.86720(50.)	9	7	3
9	7	2	991.29756(5.)	2221.02660(13.)	3439.46700(50.)	3655.67614(15.)	3750.86790(50.)	9	7	2
9	8	2	1118.33667(5.)	2360.82722(8.)	3593.47128(10.)	3776.63043(15.)	3872.87023(7.)	9	8	2
9	8	1	1118.33667(5.)	2360.82722(8.)	3593.47128(10.)	3776.63043(15.)	3872.87023(7.)	9	8	1
9	9	1	1258.87029(5.)	2514.57800(13.)	3760.88845(30.)	3913.92637(50.)	4007.22570(20.)	9	9	1
9	9	0	1258.87029(5.)	2514.57800(13.)	3760.88845(30.)	3913.92637(50.)	4007.22570(20.)	9	9	0
10	0	10	581.82393(13.)	1758.33494(9.)	2915.47175(3.)	3245.38855(15.)	3363.03778(5.)	10	0	10
10	1	10	581.84845(5.)	1758.37434(9.)	2915.53901(6.)	3245.41077(25.)	3363.03925(3.)	10	1	10
10	1	9	672.92072(8.)	1856.50040(7.)	3021.24441(20.)	3335.42967(18.)	3452.63569(7.)	10	1	9
10	2	9	673.71787(8.)	1857.68634(8.)	3023.08548(7.)	3336.17453(14.)	3456.37976(4.)	10	2	9
10	2	8	743.80360(7.)	1931.11204(3.)	3099.26261(7.)	3405.76741(40.)	3523.80321(6.)	10	2	8
10	3	8	752.61115(10.)	1942.96235(4.)	3115.53955(12.)	3414.15883(5.)	3531.84126(5.)	10	3	8
10	3	7	790.82075(9.)	1980.64643(6.)	3151.79402(8.)	3449.38852(15.)	3571.56986(10.)	10	3	7
10	4	7	826.19679(10.)	2023.75576(5.)	3204.85444(20.)	3486.79354(30.)	3603.65055(10.)	10	4	7
10	4	6	837.05136(14.)	2033.41509(4.)	3213.05636(10.)	3496.81442(16.)	3615.64201(21.)	10	4	6
10	5	6	906.94540(5.)	2113.77556(7.)	3305.87984(15.)	3565.70161(70.)	3682.29312(6.)	10	5	6
10	5	5	908.21173(5.)	2114.79372(7.)	3306.65165(7.)	3566.20613(52.)	3683.64315(10.)	10	5	5
10	6	5	1002.80682(7.)	2220.64123(7.)	3425.52115(15.)	3657.71913(80.)	3761.43722(10.)	10	6	5
10	6	4	1002.88097(9.)	2220.69678(3.)	3425.56185(15.)	3657.50896(85.)	3761.49679(5.)	10	6	4
10	7	4	1114.89583(5.)	2344.83245(8.)	3563.35187(20.)	3779.52891(31.)	3872.60530(80.)	10	7	4
10	7	3	1114.89840(4.)	2344.83415(8.)	3563.37400(20.)	3779.48757(27.)	3872.60870(80.)	10	7	3
10	8	3	1242.00639(15.)	2484.77350(14.)	3717.63625(40.)	3899.89440(50.)	3994.94797(150.)	10	8	3
10	8	2	1242.00645(10.)	2484.77362(14.)	3717.63625(40.)	3899.89440(50.)	3994.94797(150.)	10	8	2
10	9	2	1382.78786(10.)	2638.84077(8.)		4037.15108(50.)	4129.66940(300.)	10	9	2
10	9	1	1382.78786(10.)	2638.84077(8.)		4037.15108(50.)	4129.66940(300.)	10	9	1
10	10	1	1535.96807(10.)	2805.52579(8.)		4187.58674(50.)	4276.05061(50.)	10	10	1
10	10	0	1535.96807(10.)	2805.52579(8.)		4187.58674(50.)	4276.05061(50.)	10	10	0
11	0	11	693.11063(10.)	1868.88117(9.)	3025.35843(10.)	3355.09196(38.)	3473.12297(10.)	11	0	11
11	1	11	693.12152(8.)	1868.89945(5.)	3025.39107(10.)	3355.12865(15.)	3473.12507(10.)	11	1	11
11	1	10	794.43341(10.)	1978.24157(6.)	3143.44933(4.)	3455.25561(25.)	3572.71968(4.)	11	1	10
11	2	10	794.82978(7.)	1978.85688(10.)	3144.45255(20.)	3455.61814(40.)	3572.63193(9.)	11	2	10
11	2	9	877.11648(6.)	2065.75784(4.)	3235.50094(20.)	3537.20528(40.)	3655.12777(10.)	11	2	9
11	3	9	882.41185(8.)	2073.23225(6.)	3246.33385(10.)	3542.20800(36.)	3660.86837(6.)	11	3	9
11	3	8	934.05240(9.)	2124.88080(8.)	3296.85444(30.)	3594.26677(13.)	3713.43505(20.)	11	3	8
11	4	8	961.33878(6.)	2159.25934(7.)	3340.64085(20.)	3620.16660(20.)	3738.06736(10.)	11	4	8
11	4	7	980.25786(4.)	2176.47303(9.)	3355.64333(7.)	3637.72025(50.)	3758.49010(4.)	11	4	7
11	5	7	1043.50482(5.)	2250.47933(6.)	3442.61462(10.)	3700.93900(55.)	3818.51018(10.)	11	5	7
11	5	6	1046.53056(4.)	2252.93733(4.)	3444.49256(40.)	3702.54409(50.)	3821.69292(10.)	11	5	6
11	6	6	1139.06060(16.)	2357.02087(9.)	3561.93460(15.)	3792.23000(400.)	3915.50490(70.)	11	6	6
11	6	5	1139.29405(10.)	2357.19598(10.)	3562.06300(25.)	3791.77980(50.)	3915.64249(45.)	11	6	5
11	7	5	1250.84804(3.)	2480.98050(5.)	3699.39597(40.)	3895.37429(25.)	4006.60456(40.)	11	7	5
11	7	4	1250.85866(5.)	2480.98805(8.)	3699.59560(30.)	3895.19960(60.)	4006.61844(40.)	11	7	4
11	8	4	1377.94631(8.)	2620.98681(7.)	3854.05450(30.)	4035.31463(15.)	4129.19410(50.)	11	8	4
11	8	3	1377.94730(6.)	2620.98726(40.)	3854.05450(30.)	4035.31128(50.)	4129.19460(50.)	11	8	3
11	9	3	1518.93440(35.)	2775.33629(40.)		4172.49219(230.)	4264.23470(50.)	11	9	3
11	9	2	1518.93440(35.)	2775.33629(40.)		4172.49219(230.)	4264.23470(50.)	11	9	2
11	10	2	1672.48102(25.)	2942.46237(20.)		4411.09682(50.)	4411.09682(50.)	11	10	2

Table 1 continued

J	K _a	k _c	(000)	(010)	(020)	(100)	(001)	J	K _a	k _c
11	10	1	1672.48102(25.)	2942.46237(20.)			4411.09682(50.)	11	10	1
11	11	1	1837.32708(15.)	3120.90575(30.)				11	11	1
11	11	0	1837.32708(15.)	3120.90575(30.)				11	11	0
12	0	12	813.97412(5.)	1988.90170(3.)	3144.61987(12.)	3474.29300(150.)	3592.67850(40.)	12	0	12
12	1	12	813.97893(11.)	1988.91010(9.)	3144.63570(20.)	3474.29700(150.)	3592.68042(40.)	12	1	12
12	1	11	925.36992(6.)	2109.27366(6.)	3274.80291(6.)	3584.35810(38.)	3702.14585(10.)	12	1	11
12	2	11	925.56380(9.)	2109.58765(5.)	3275.34009(10.)	3584.54441(300.)	3702.16826(15.)	12	2	11
12	2	10	1019.28314(9.)	2209.17094(4.)	3380.60430(900.)	3677.37460(40.)	3795.24920(6.)	12	2	10
12	3	10	1022.29858(6.)	2213.63261(4.)	3387.34321(20.)	3680.20073(60.)	3801.95573(10.)	12	3	10
12	3	9	1087.98364(13.)	2280.21226(8.)	3453.49370(20.)	3745.87577(50.)	3865.46844(40.)	12	3	9
12	4	9	1107.71517(5.)	2306.11697(8.)	3487.91980(40.)	3764.62100(400.)	3883.66019(20.)	12	4	9
12	4	8	1137.30107(8.)	2333.64985(8.)	3512.50183(7.)	3790.12097(25.)	3914.82760(33.)	12	4	8
12	5	8	1192.29866(5.)	2399.47555(10.)	3591.68028(15.)	3847.08400(400.)	3966.80617(50.)	12	5	8
12	5	7	1198.67889(12.)	2404.73857(12.)	3595.78275(9.)	3852.36035(300.)	3973.45055(25.)	12	5	7
12	6	7	1287.77402(12.)	2505.84816(7.)	3710.76287(30.)	3939.34436(50.)	4063.74260(40.)	12	6	7
12	6	6	1288.41189(10.)	2506.32886(7.)	3711.11059(40.)	3938.61168(25.)	4064.14402(40.)	12	6	6
12	7	6	1399.14738(10.)	2629.45680(6.)		4041.79005(50.)	4152.85604(40.)	12	7	6
12	7	5	1399.18465(6.)	2629.48308(10.)		4041.35086(40.)	4152.90342(8.)	12	7	5
12	8	5	1526.12910(10.)	2769.43196(40.)		4182.86900(400.)	4275.58470(80.)	12	8	5
12	8	4	1526.13040(10.)	2769.43261(6.)		4182.85984(250.)	4275.58690(80.)	12	8	4
12	9	4	1667.26484(30.)	2924.01166(8.)		4319.90240(300.)	4410.88062(400.)	12	9	4
12	9	3	1667.26484(30.)	2924.01166(8.)		4319.90240(300.)	4410.88062(400.)	12	9	3
12	10	3	1821.15187(65.)	3091.55784(25.)			4558.23302(300.)	12	10	3
12	10	2	1821.15187(65.)	3091.55784(25.)			4558.23302(300.)	12	10	2
12	11	2	1986.48499(20.)	3270.57230(100.)				12	11	2
12	11	1	1986.48499(20.)	3270.57230(100.)				12	11	1
13	0	13	944.39835(6.)	2118.38294(11.)	3273.24430(50.)	3602.89430(80.)	3721.69173(23.)	13	0	13
13	1	13	944.40055(5.)	2118.38697(6.)	3273.25460(20.)	3602.89550(80.)	3721.69591(40.)	13	1	13
13	1	12	1065.76791(7.)	2249.65282(8.)	3415.38362(30.)	3722.81116(40.)	3840.94162(10.)	13	1	12
13	2	12	1065.86209(8.)	2249.81169(5.)	3415.66881(10.)	3722.90167(40.)	3840.96128(20.)	13	2	12
13	2	11	1170.37052(7.)	2361.32957(8.)	3534.14290(40.)	3826.34900(300.)	3944.29870(20.)	13	2	11
13	3	11	1172.02345(5.)	2363.88827(6.)	3538.26605(15.)	3827.88535(50.)	3944.03730(20.)	13	3	11
13	3	10	1251.55354(14.)	2445.53228(6.)			4026.65586(5.)	13	3	10
13	4	10	1264.89935(6.)	2463.90573(6.)			4040.31585(8.)	13	4	10
13	4	9	1307.30533(4.)	2504.20267(7.)			4083.65448(15.)	13	4	9
13	5	9	1353.04520(10.)	2560.51479(10.)			4126.94196(40.)	13	5	9
13	5	8	1365.03996(13.)	2570.62037(20.)		4015.73167(50.)	4139.29280(30.)	13	5	8
13	6	8	1448.88732(9.)	2667.07352(12.)			4224.18602(50.)	13	6	8
13	6	7	1450.43805(10.)	2668.25058(10.)			4225.22139(40.)	13	6	7
13	7	7	1559.78170(9.)	2790.24185(15.)		4200.81689(50.)	4311.35038(40.)	13	7	7
13	7	6	1559.89548(10.)	2790.32221(10.)		4199.84912(50.)	4311.48505(40.)	13	7	6
13	8	6	1686.52430(30.)	2930.06936(120.)			4434.09700(300.)	13	8	6
13	8	5	1686.52994(20.)	2930.07263(20.)			4434.10500(300.)	13	8	5
13	9	5	1827.73009(25.)	3084.80984(60.)			4569.57731(60.)	13	9	5
13	9	4	1827.73029(40.)	3084.80984(60.)			4569.57731(60.)	13	9	4
13	10	4	1981.91402(25.)	3252.74076(50.)				13	10	4
13	10	3	1981.91402(25.)	3252.74076(50.)				13	10	3
13	11	3	2147.71975(40.)					13	11	3
13	11	2	2147.71975(40.)					13	11	2
14	0	14	1084.36487(25.)	2257.30827(6.)	3411.22446(10.)	3740.90430(20.)	3860.14403(30.)	14	0	14
14	1	14	1084.36550(25.)	2257.31026(8.)	3411.22830(40.)	3740.90480(60.)	3860.14403(30.)	14	1	14
14	1	13	1215.63877(5.)	2399.40374(5.)	3565.23595(20.)	3870.60200(300.)	3989.11240(80.)	14	1	13
14	2	13	1215.68416(5.)	2399.48363(5.)	3565.38500(200.)	3870.65409(50.)	3989.12359(40.)	14	2	13
14	2	12	1330.52460(5.)	2522.36585(6.)	3696.44739(20.)	3984.27445(300.)	4102.41361(30.)	14	2	12
14	3	12	1331.40786(6.)	2523.79406(5.)			4102.52962(40.)	14	3	12
14	3	11	1424.00370(20.)	2619.92574(8.)			4196.42250(40.)	14	3	11
14	4	11	1432.49122(8.)	2632.21343(6.)			4208.99506(37.)	14	4	11
14	4	10	1489.18825(15.)	2687.12564(8.)			4263.78483(40.)	14	4	10
14	5	10	1525.38550(20.)	2733.26866(17.)			4298.67408(40.)	14	5	10
14	5	9	1545.67311(10.)	2750.80223(15.)		4191.37535(50.)	4319.21424(40.)	14	5	9
14	6	9	1622.27990(20.)	2840.59652(20.)			4396.76132(300.)	14	6	9
14	6	8	1625.67680(15.)	2843.20283(9.)		4270.48320(300.)	4399.17845(40.)	14	6	8
14	7	8	1732.72669(15.)	2963.30603(10.)			4482.05063(400.)	14	7	8
14	7	7	1733.03438(20.)	2963.52425(15.)		4370.65872(50.)	4482.40158(50.)	14	7	7
14	8	7	1859.11094(15.)	3102.85748(40.)				14	8	7
14	8	6	1859.11910(20.)	3102.86961(40.)		4514.27260(50.)		14	8	6
14	9	6	2000.28100(70.)	3257.67186(90.)				14	9	6
14	9	5	2000.28164(70.)	3257.67230(90.)				14	9	5
14	10	5	2154.70580(40.)	3425.94100(300.)				14	10	5
14	10	4	2154.70580(40.)	3425.94100(300.)				14	10	4
15	0	15	1233.85214(20.)	2405.65797(15.)	3558.53710(70.)	3888.30900(80.)	4008.01161(20.)	15	0	15

Table 1 continued

J	K _a	k _c	(000)	(010)	(020)	(100)	(001)	J	K _a	k _c
15	1	15	1233.85274(11.)	2405.65889(10.)	3558.53868(30.)	3888.31100(80.)	4008.01161(20.)	15	1	15
15	1	14	1374.97638(10.)	2558.53085(6.)			4146.65047(40.)	15	1	14
15	2	14	1374.99848(8.)	2558.57134(7.)		4027.76498(300.)	4146.65616(40.)	15	2	14
15	2	13	1499.86541(7.)	2692.42180(20.)			4269.68410(40.)	15	2	13
15	3	13	1500.33018(10.)	2693.20539(5.)			4269.78086(40.)	15	3	13
15	3	12	1605.00825(30.)	2802.85816(11.)			4374.65487(58.)	15	3	12
15	4	12	1610.14255(10.)	2810.66988(15.)				15	4	12
15	4	11	1681.79006(8.)	2881.29248(20.)			4453.99950(40.)	15	4	11
15	5	11	1708.91032(10.)	2917.34974(10.)			4481.89150(300.)	15	5	11
15	5	10	1740.15770(20.)	2945.09610(15.)				15	5	10
15	6	10	1807.75400(30.)	3026.24942(10.)				15	6	10
15	7	9	1917.93444(15.)	3148.60342(25.)				15	7	9
16	0	16	1392.83839(15.)	2563.41205(12.)	3715.16615(80.)	4044.93474(300.)	4165.27250(300.)	16	0	16
16	1	16	1392.83859(15.)	2563.41221(15.)	3715.16615(80.)	4044.93474(300.)	4165.27250(300.)	16	1	16
16	1	15	1543.76700(10.)	2727.02708(8.)			4313.53869(40.)	16	1	15
16	2	15	1543.77735(10.)	2727.04715(6.)			4313.54037(80.)	16	2	15
16	2	14	1678.46540(10.)	2871.59838(6.)			4446.15201(40.)	16	2	14
16	3	14	1678.70696(10.)	2872.02360(60.)			4446.20799(40.)	16	3	14
16	3	13	1794.57866(10.)	2994.18763(10.)				16	3	13
16	4	13	1797.57309(20.)	2998.96400(15.)				16	4	13
16	4	12	1884.00564(50.)	3085.56383(15.)				16	4	12
17	0	17	1561.29835(20.)	2730.54726(15.)		4211.14334(50.)	4331.90949(40.)	17	0	17
17	1	17	1561.29845(15.)	2730.54726(15.)		4211.14334(50.)	4331.90949(40.)	17	1	17
17	1	16	1721.98903(10.)	2904.87688(15.)			4489.75257(40.)	17	1	16
17	2	16	1721.99445(15.)	2904.88762(8.)				17	2	16
17	2	15	1866.35565(30.)	3059.95138(10.)				17	2	15
17	3	15	1866.48135(10.)	3060.18140(15.)			4631.85796(300.)	17	3	15
17	3	14	1992.86727(15.)	3194.00948(15.)			4757.07856(40.)	17	3	14
17	4	14	1994.57055(20.)	3196.85088(10.)				17	4	14
18	0	18	1739.20773(20.)	2907.03930(15.)			4507.88759(50.)	18	0	18
18	1	18	1739.20794(55.)	2907.03930(15.)			4507.88759(50.)	18	1	18
18	1	17	1909.61975(25.)	3092.06269(15.)			4675.27960(50.)	18	1	17
18	2	17	1909.62145(20.)	3092.06773(15.)			4675.27960(50.)	18	2	17
18	2	16	2063.54358(25.)	3257.50508(200.)				18	2	16
18	3	16	2063.60836(20.)	3257.62943(20.)				18	3	16
18	3	15	2200.02908(15.)	3402.48787(15.)				18	3	15
18	4	15	2200.98197(15.)	3404.14748(20.)				18	4	15
19	0	19	1926.53769(15.)	3092.86420(20.)			4693.18394(50.)	19	0	19
19	1	19	1926.53769(15.)	3092.86420(20.)			4693.18394(50.)	19	1	19
19	1	18	2106.63055(30.)	3288.56021(30.)				19	1	18
19	2	18	2106.63151(30.)	3288.56388(30.)				19	2	18
19	2	17	2270.01827(40.)	3464.26589(500.)				19	2	17
19	3	17	2270.05156(200.)	3464.32979(30.)				19	3	17
19	3	16	2416.17109(30.)	3619.76334(100.)				19	3	16
19	4	16	2416.69947(30.)	3620.72224(40.)				19	4	16
20	0	20	2123.26081(25.)	3287.99371(30.)				20	0	20
20	1	20	2123.26081(25.)	3287.99371(30.)				20	1	20
20	1	19	2312.99589(30.)	3494.34868(30.)				20	1	19
20	2	19	2312.99620(50.)	3494.34900(100.)				20	2	19
20	2	18	2485.75969(40.)	3680.21253(200.)				20	2	18
20	3	18	2485.78000(500.)	3680.25591(500.)				20	3	18
20	3	17	2641.35439(50.)	3845.92976(30.)				20	3	17
21	1	21	2329.34582(30.)	3492.40143(20.)				21	1	21
21	0	21	2329.34582(30.)	3492.40143(20.)				21	0	21
21	1	20	2528.68030(50.)	3709.40030(100.)				21	1	20
21	2	20	2528.68068(40.)	3709.40034(30.)				21	2	20
21	2	19	2710.75106(500.)	3905.34000(200.)				21	2	19
21	3	19	2710.75106(500.)	3905.35470(50.)				21	3	19
21	3	18	2875.63597(50.)					21	3	18
22	0	22	2544.76251(35.)	3706.05634(30.)				22	0	22
22	1	22	2544.76251(35.)					22	1	22
22	1	21	2753.65683(40.)	3933.64400(300.)				22	1	21
22	2	21	2753.65683(40.)	3933.64400(300.)				22	2	21
22	2	20	2944.93192(50.)	4139.61500(400.)				22	2	20
22	3	20	2944.93500(200.)	4139.60544(500.)				22	3	20
23	0	23	2769.47602(40.)	3928.92755(50.)				23	0	23
23	1	23	2769.47602(40.)	3928.92755(50.)				23	1	23

Values given within parentheses are uncertainties in the last digits

Table 2. Rotational energy levels of D₂¹⁷O for the (000) and (010) vibrational states.

j k _A k _C	(000)	(010)	J k _a k _c	(000)	(010)
0 0 0		1174.04666(10.)	7 4 4	488.90375(20.)	1681.31470(30.)
1 0 1	12.09860(5.)	1186.15492(15.)	7 4 3	489.83564(20.)	1682.10836(10.)
1 1 1	20.05686(5.)	1195.24237(10.)	7 5 3	567.46700(20.)	1769.26813(10.)
1 1 0	22.50092(5.)	1197.80479(20.)	7 5 2	567.50530(40.)	1769.29926(30.)
2 0 2	35.80690(5.)	1209.89310(20.)	7 6 2	662.33713(50.)	1874.91164(50.)
2 1 2	41.81155(8.)	1216.89600(50.)	7 6 1	662.33820(50.)	1874.91359(60.)
2 1 1	49.13783(10.)	1224.57937(10.)	7 7 1	772.53150(80.)	1996.91562(40.)
2 2 1	72.92584(10.)	1251.70604(8.)	7 7 0	772.53150(80.)	1996.91562(40.)
2 2 0	73.40730(6.)	1252.17537(10.)	8 0 8	386.56185(30.)	1559.90166(15.)
3 0 3	70.26394(30.)	1244.41133(15.)	8 1 8	386.67137(10.)	1560.06385(20.)
3 1 3	74.15610(30.)	1249.10137(7.)	8 1 7	456.34995(20.)	1634.67588(10.)
3 1 2	88.73038(20.)	1264.38542(7.)	8 2 7	459.03700(40.)	1638.37481(40.)
3 2 2	109.22774(6.)	1288.04267(15.)	8 2 6	503.92299(40.)	1684.54057(20.)
3 2 1	111.51354(30.)	1290.28582(10.)	8 3 6	522.41540(50.)	1707.55300(15.)
3 3 1	154.94723(10.)	1339.45210(15.)	8 3 5	539.34710(30.)	1723.71917(30.)
3 3 0	155.00828(10.)	1339.50735(30.)	8 4 5	588.00740(20.)	1780.53985(35.)
4 0 4	114.63062(7.)	1288.82807(7.)	8 4 4	590.57150(30.)	1782.73176(15.)
4 1 4	116.82745(15.)	1291.58408(7.)	8 5 4	666.45227(30.)	1868.34639(30.)
4 1 3	140.76570(5.)	1316.73700(30.)	8 5 3	666.60888(25.)	1868.46812(15.)
4 2 3	157.21555(15.)	1336.08725(12.)	8 6 3	761.10950(50.)	1973.80020(200.)
4 2 2	163.45593(7.)	1342.25978(7.)	8 6 2	761.11342(25.)	1973.80396(60.)
4 3 2	204.17680(15.)	1388.72322(5.)	8 7 2	871.30771(45.)	
4 3 1	204.59054(15.)	1389.10127(6.)	8 7 1	871.30771(40.)	
4 4 1	266.45655(80.)	1458.66290(20.)	8 8 1	995.82458(80.)	
4 4 0	266.46364(10.)	1458.66822(30.)	8 8 0	995.82458(80.)	
5 0 5	168.45530(10.)	1342.63142(10.)	9 0 9	478.30941(50.)	1651.12852(10.)
5 1 5	169.57816(10.)	1344.10102(10.)	9 1 9	478.35975(15.)	1651.20491(20.)
5 1 4	204.46690(25.)	1380.87710(10.)	9 1 8	558.83470(30.)	1737.68674(200.)
5 2 4	216.56457(20.)	1395.51397(10.)	9 2 8	560.24068(16.)	1739.71302(20.)
5 2 3	229.26900(15.)	1408.22166(10.)	9 2 7	618.02130(300.)	1799.74840(10.)
5 3 3	265.75255(10.)	1450.36950(40.)	9 3 7	630.77150(30.)	1816.23950(15.)
5 3 2	267.31881(50.)	1451.79680(30.)	9 3 6	657.86240(50.)	1842.51869(300.)
5 4 2	328.09442(10.)	1520.35916(5.)	9 4 6	699.36785(50.)	1892.06200(30.)
5 4 1	328.14860(10.)	1520.40710(30.)	9 4 5	705.26187(200.)	1897.16294(150.)
5 5 1	407.02835(15.)	1608.64354(10.)	9 5 5	777.98288(15.)	1979.96567(20.)
5 5 0	407.02880(40.)	1608.64416(50.)	9 5 4	778.50000(600.)	1980.37197(50.)
6 0 6	231.67980(20.)	1405.70664(20.)	9 6 4	872.32405(20.)	
6 1 6	232.21518(16.)	1406.43750(10.)	9 6 3	872.34929(60.)	
6 1 5	278.84782(40.)	1455.84421(10.)	10 0 10	579.61892(20.)	1751.80365(15.)
6 2 5	286.89285(30.)	1465.95272(20.)	10 1 10	579.63964(20.)	1751.83847(200.)
6 2 4	308.49988(10.)	1487.77360(30.)	10 1 9	670.53101(15.)	1849.75551(15.)
6 3 4	339.51643(15.)	1524.23963(30.)	10 2 9	671.23500(500.)	1850.81995(50.)
6 3 3	343.79315(25.)	1528.18963(10.)	10 2 8	741.78014(30.)	1924.75541(20.)
6 4 3	402.23770(20.)	1594.57081(10.)	10 3 8	749.84400(40.)	
6 4 2	402.51092(15.)	1594.79970(40.)	11 0 11	690.47898(100.)	1861.94400(200.)
6 5 2	481.00795(30.)	1682.71643(40.)	11 1 11	690.48825(35.)	1861.95346(100.)
6 5 1	481.01412(15.)	1682.72058(15.)	11 1 10	791.57000(600.)	1970.99286(200.)
6 6 1	575.98147(50.)	1788.42220(100.)	11 2 10	791.91000(600.)	1971.54091(15.)
6 6 0	575.98147(50.)	1788.42220(100.)	11 2 9	874.50000(600.)	
7 0 7	304.35904(50.)	1478.10758(10.)	11 3 9	879.24853(50.)	
7 1 7	304.60688(40.)	1478.45905(15.)	12 0 12	810.90300(500.)	1981.50067(100.)
7 1 6	362.98563(20.)	1540.65662(30.)	12 1 12	810.90300(500.)	1981.50930(100.)
7 2 6	367.83310(6.)	1547.02337(10.)	12 1 11	922.00700(80.)	2101.51503(600.)
7 2 5	400.37255(20.)	1580.19123(15.)	13 0 13	940.82000(600.)	2110.49595(500.)
7 3 5	425.19200(20.)	1610.08646(10.)	13 1 13	940.82000(600.)	2110.50354(500.)
7 3 4	434.47500(10.)	1618.79024(10.)			

Values given within parentheses are uncertainties in the last digits.

Table 3. Vibration-rotation energy level parameters of the (000)
state of $D_2^{17}O^a$

A	15.23623 (2)
B	7.27308 (2)
C	4.82676 (2)
Δ_k	9.05146 (100) E-03
Δ_{JK}	-1.50704 (200) E-03
Δ_J	3.09635 (150) E-04
H_k	1.8214 (100) E-05
H_{KJ}	-3.13 (7) E-06
H_J	6.7 (4) E-08
δ_k	3.2200 (90) E-04
δ_J	1.23 (2) E-04
h_k	3.62 (33) E-06

note. values given within parentheses are estimated
uncertainties in the last digits.

a. Constants derived from J levels of 6 and less

Table 4. Dipole moment expansion coefficients derived from least-squares fits of the (010)-(000) bands of $D_2^{16}O$, $D_2^{17}O$, and $D_2^{18}O$ and the (020)-(010), (100)-(000), and (001)-(010) bands of $D_2^{16}O$. Values given in Debye^a

j	(010)-(000) band			
	$D_2^{16}O$	$D_2^{18}O$	$D_2^{17}O$	
1	1.098(5) $\times 10^{-1}$	1.089(5) $\times 10^{-1}$	1.092(6) $\times 10^{-1}$	1.101(6) $\times 10^{-1}$
2	2.23(11) $\times 10^{-5}$	1.91(10) $\times 10^{-5}$	1.31(7) $\times 10^{-5}$	-2.61(13) $\times 10^{-6}$
3	8.39(42) $\times 10^{-5}$	1.02(5) $\times 10^{-5}$	6.81(33) $\times 10^{-6}$	-9.48(10) $\times 10^{-5}$
4	-3.72(19) $\times 10^{-3}$	-4.21(21) $\times 10^{-3}$	-4.24(22) $\times 10^{-3}$	-4.18(20) $\times 10^{-3}$
5	-3.50(17) $\times 10^{-4}$	-1.38(7) $\times 10^{-4}$	-1.72(9) $\times 10^{-4}$	-2.00(10) $\times 10^{-4}$
6	-3.63(18) $\times 10^{-5}$	-1.68(8) $\times 10^{-5}$	-1.33(7) $\times 10^{-5}$	-5.85(31) $\times 10^{-6}$
7	3.17(16) $\times 10^{-5}$	1.89(9) $\times 10^{-5}$	2.04(10) $\times 10^{-5}$	1.88(9) $\times 10^{-5}$
8	-2.58(13) $\times 10^{-5}$	-9.61(48) $\times 10^{-6}$	-1.29(6) $\times 10^{-5}$	-1.52(8) $\times 10^{-5}$
9		-1.45(7) $\times 10^{-6}$		
10	6.98(35) $\times 10^{-6}$	3.54(18) $\times 10^{-6}$	4.62(22) $\times 10^{-6}$	3.31(17) $\times 10^{-6}$
11		-7.84(39) $\times 10^{-8}$		
12				
13		-5.42(27) $\times 10^{-9}$		
14		1.19(6) $\times 10^{-8}$		
15		-3.93(20) $\times 10^{-7}$	-1.46(7) $\times 10^{-6}$	6.01(31) $\times 10^{-7}$
16		1.97(10) $\times 10^{-8}$		

N ^b	574	490	365	117
$\sigma\%$ ^c	3.52	3.09	3.09	3.88
min v	727.194cm ⁻¹	1201.995cm ⁻¹	926.117cm ⁻¹	995.997cm ⁻¹
max v	1199.980cm ⁻¹	1612.476cm ⁻¹	1453.719cm ⁻¹	1389.394cm ⁻¹

j	(020)-(010) band	$D_2^{16}O$	(001)-(010) band	
		(100)-(010) band		
1	-1.625(8) $\times 10^{-1}$	3.401(17) $\times 10^{-2}$	1.785(9) $\times 10^{-2}$	
2	-7.04(35) $\times 10^{-7}$	1.56(9) $\times 10^{-5}$	-1.86(9) $\times 10^{-5}$	
3	6.07(30) $\times 10^{-5}$	1.01(5) $\times 10^{-4}$	2.59(13) $\times 10^{-5}$	
4	7.41(37) $\times 10^{-3}$	-9.54(48) $\times 10^{-4}$	2.45(12) $\times 10^{-4}$	
5	2.81(14) $\times 10^{-4}$	-9.42(47) $\times 10^{-6}$	-1.69(8) $\times 10^{-5}$	
6	2.26(11) $\times 10^{-5}$	-2.24(11) $\times 10^{-5}$	-2.26(11) $\times 10^{-4}$	
7	-4.43(22) $\times 10^{-5}$	1.42(7) $\times 10^{-5}$	2.70(14) $\times 10^{-4}$	
8	7.72(39) $\times 10^{-5}$	1.44(7) $\times 10^{-5}$	-2.08(10) $\times 10^{-5}$	
9				
10	-1.86(9) $\times 10^{-5}$	-8.47(42) $\times 10^{-8}$		
15	-1.32(7) $\times 10^{-6}$	-1.25(6) $\times 10^{-6}$		

N ^b	353	50	46
$\sigma\%$ ^c	5.69	5.42	5.07
min v	900.662cm ⁻¹	1277.355cm ⁻¹	1519.208cm ⁻¹
max v	1460.631cm ⁻¹	1621.950cm ⁻¹	1723.781cm ⁻¹

^a Values given within parentheses are uncertainties in the last digit(s).

^b N represents the number of line strengths used in the least-squares fits.

^c $\sigma\%$ is the standard deviation resulting from the least-squares fit in percent;

$$\sigma\% = \{\sum [(S_{obs} - S_{cal})^2 / S_{obs}]^2 / N\}^{1/2} \times 100.$$

Table 5. Line positions and strengths of the (010)-(000) band of D₂¹⁷O. Strengths in units of cm⁻²/atm. at 296 K.

observed position	o-c	upper J K _a K _c	lower J K _a K _c	observed strength	#s	computed strength	(o-c) %
995.99710	0.	8 5 4	9 6 3	1.78E-05	4.	1.90E-05	-6.6
996.14407	0.	8 5 3	9 6 4	3.87E-05	4.	3.80E-05	1.8
*1001.09104	0.	7 7 1	8 8 0	5.22E-05	8.	4.91E-05	6.2
1004.74887	-1.	8 4 4	9 5 5	4.66E-05	9.	4.45E-05	4.7
1008.15477	6.	7 5 3	8 6 2	6.67E-05	3.	6.62E-05	.7
1008.18976	0.	7 5 2	8 6 3	3.64E-05	17.	3.31E-05	9.5
1014.70548	-34.	7 4 4	8 5 3	7.76E-05	12.	7.84E-05	-1.0
1015.65609	0.	7 4 3	8 5 4	3.84E-05	10.	3.93E-05	-2.3
*1015.89055	-15.	6 6 0	7 7 1	1.26E-04	13.	1.21E-04	4.3
1020.37832	9.	6 5 2	7 6 1	5.64E-05	3.	5.42E-05	3.9
1020.38356	11.	6 5 1	7 6 2	1.23E-04	22.	1.08E-04	12.5
1024.35149	17.	8 3 5	9 4 6	4.76E-05	14.	4.46E-05	6.4
1030.78309	25.	7 3 4	8 4 5	4.30E-05	7.	3.94E-05	8.7
1031.47788	16.	6 2 5	7 3 4	3.89E-05	13.	3.67E-05	5.7
*1032.66207	0.	5 5 1	6 6 0	2.46E-04	6.	2.52E-04	-2.4
1035.60109	-5.	5 1 5	6 2 4	3.18E-05	15.	3.49E-05	-9.3
1039.28583	-5.	6 3 3	7 4 4	1.30E-04	6.	1.32E-04	-1.6
1039.34507	3.	5 4 2	6 5 1	2.06E-04	4.	2.01E-04	2.6
1039.39931	16.	5 4 1	6 5 2	1.01E-04	6.	1.00E-04	.6
1040.68067	0.	12 0 12	13 1 13	3.12E-05	19.	3.10E-05	.6
1045.50688	0.	10 2 8	11 3 9	2.13E-05	22.	2.20E-05	-3.3
1047.85860	2.	5 3 3	6 4 2	2.12E-04	4.	2.05E-04	3.2
1049.55900	-10.	5 3 2	6 4 3	1.11E-04	9.	1.04E-04	7.0
1049.90440	0.	9 2 7	10 3 8	1.72E-05	4.	1.80E-05	-4.5
1051.64003	16.	4 4 0	5 5 1	2.78E-04	13.	2.93E-04	-5.4
1051.72082	0.	5 2 4	6 3 3	1.40E-04	7.	1.42E-04	-1.5
1053.76913	6.	8 2 6	9 3 7	5.95E-05	19.	5.65E-05	5.2
1057.77558	-25.	7 2 5	8 3 6	4.56E-05	21.	4.30E-05	5.8
1060.57459	-3.	4 3 2	5 4 1	1.58E-04	8.	1.52E-04	4.2
1061.00684	-1.	4 3 1	5 4 2	3.02E-04	5.	3.04E-04	-.5
1061.31569	29.	10 0 10	11 1 11	8.79E-05	7.	9.12E-05	-3.7
1062.31512	4.	4 1 4	5 2 3	3.42E-05	10.	3.59E-05	-4.8
1062.58147	-13.	6 2 4	7 3 5	1.23E-04	5.	1.28E-04	-4.3
1068.70523	0.	5 2 3	6 3 4	9.93E-05	5.	9.37E-05	5.8
1069.18191	-10.	9 2 8	10 1 9	7.86E-05	7.	7.11E-05	10.1
1070.04346	0.	11 1 11	11 2 10	2.55E-05	6.	2.64E-05	-3.5
1071.48888	0.	9 0 9	10 1 10	7.13E-05	13.	7.18E-05	-.8
1071.58599	0.	9 1 9	10 0 10	1.40E-04	10.	1.44E-04	-2.6
1072.98846	0.	3 3 1	4 4 0	4.83E-04	15.	4.19E-04	14.1
1074.43521	1.	8 1 7	9 2 8	1.15E-04	15.	1.08E-04	6.5
1076.50723	0.	4 2 2	5 3 3	2.60E-04	7.	2.66E-04	-2.2
1079.54011	0.	8 2 7	9 1 8	6.00E-05	14.	5.22E-05	14.0
1081.54194	3.	8 0 8	9 1 9	2.06E-04	7.	2.13E-04	-3.4
1081.75444	0.	8 1 8	9 0 9	1.12E-04	8.	1.06E-04	5.1
1083.45190	-23.	3 2 2	4 3 1	3.36E-04	4.	3.51E-04	-4.4
1085.64545	1.	3 1 3	4 2 2	1.32E-04	6.	1.39E-04	-5.2
1086.10914	12.	3 2 1	4 3 2	1.80E-04	4.	1.81E-04	-.6
1088.01109	-2.	6 1 5	7 2 6	2.01E-04	4.	1.95E-04	3.2
1090.67345	3.	7 2 6	8 1 7	1.40E-04	6.	1.39E-04	.6
1091.43614	-7.	7 0 7	8 1 8	1.46E-04	6.	1.48E-04	-1.6
1091.89730	10.	7 1 7	8 0 8	2.90E-04	3.	2.96E-04	-2.0
1093.98425	0.	5 1 4	6 2 5	1.28E-04	6.	1.20E-04	6.7
1096.69776	0.	2 2 1	3 3 0	2.30E-04	2.	2.34E-04	-1.6
1097.22813	-1.	2 2 0	3 3 1	4.69E-04	3.	4.70E-04	-.2
1100.97615	20.	10 2 9	10 3 8	2.54E-05	5.	2.74E-05	-7.6
1101.02662	-23.	8 1 8	8 2 7	5.95E-05	7.	5.54E-05	7.1
1101.09976	0.	6 0 6	7 1 7	3.72E-04	3.	3.85E-04	-3.5
1102.07846	0.	6 1 6	7 0 7	1.88E-04	4.	1.92E-04	-1.9
1103.55166	-5.	8 0 8	8 1 7	1.12E-04	9.	1.13E-04	-.9
1105.38239	-7.	2 1 2	3 2 1	1.28E-04	5.	1.19E-04	7.2
1106.93097	-3.	7 5 3	7 6 2	4.18E-05	20.	4.24E-05	-1.5
1106.96106	0.	7 5 2	7 6 1	2.13E-05	2.	2.12E-05	.5
1107.16986	-1.	3 1 2	4 2 3	1.69E-04	8.	1.62E-04	4.2

Table 5. continued

observed position	o-c	upper J K _a K _c	lower J K _a K _c	observed strength	%	computed strength	(o-c)%
1107.35465	-5.	8 5 3	8 6 2	3.91E-05	14.	3.82E-05	2.3
1107.64159	-3.	9 5 5	9 6 4	2.66E-05	25.	2.91E-05	-9.0
1107.97537	0.	10 1 9	10 2 8	5.69E-05	10.	5.83E-05	-2.5
1108.94139	-13.	9 2 8	9 3 7	9.20E-05	9.	9.06E-05	1.5
1110.41626	2.	5 0 5	6 1 6	2.30E-04	4.	2.32E-04	-.8
1113.33081	0.	5 4 2	5 5 1	7.34E-05	6.	7.11E-05	3.1
1113.84778	8.	7 4 4	7 5 3	9.05E-05	4.	8.99E-05	-.7
1115.12199	4.	7 0 7	7 1 6	9.31E-05	4.	8.40E-05	10.2
1115.35164	1.	2 1 1	3 2 2	3.49E-04	4.	3.60E-04	-3.1
1116.12293	5.	8 4 4	8 5 3	7.76E-05	7.	7.28E-05	6.4
1116.66615	0.	5 2 4	6 1 5	1.73E-04	8.	1.68E-04	3.2
1116.87150	-15.	9 3 7	9 4 6	7.55E-05	26.	7.85E-05	-3.9
1119.24991	0.	4 0 4	5 1 5	5.22E-04	4.	5.12E-04	1.9
1122.00166	-27.	6 3 4	6 4 3	9.36E-05	7.	9.03E-05	3.6
1122.26667	0.	4 3 2	4 4 1	6.40E-05	8.	6.44E-05	-.7
1122.63762	-1.	4 3 1	4 4 0	1.23E-04	6.	1.29E-04	-4.8
1123.12875	-3.	4 1 4	5 0 5	2.39E-04	4.	2.46E-04	-2.7
1123.86703	-5.	6 3 4	7 2 5	2.30E-05	7.	2.19E-05	5.1
1124.87895	0.	1 1 0	2 2 1	1.92E-04	7.	1.97E-04	-2.3
1126.43637	8.	6 2 5	6 3 4	1.38E-04	6.	1.29E-04	7.0
1127.53653	8.	5 1 5	5 2 4	2.83E-04	3.	2.77E-04	2.0
1127.58381	-7.	3 0 3	4 1 4	2.67E-04	5.	2.58E-04	3.4
1128.95453	-7.	7 3 4	7 4 3	7.50E-05	2.	8.00E-05	-6.5
1129.76142	0.	5 2 4	5 3 3	2.82E-04	6.	2.94E-04	-4.2
1130.75283	-6.	8 1 7	8 2 6	1.79E-04	4.	1.75E-04	2.4
1131.91044	-1.	4 2 3	4 3 2	1.29E-04	5.	1.42E-04	-9.4
1133.14765	-2.	8 3 5	8 4 4	1.23E-04	10.	1.26E-04	-2.6
1134.36871	18.	4 1 4	4 2 3	1.77E-04	7.	1.58E-04	11.1
1134.47075	0.	3 1 3	4 0 4	4.70E-04	10.	4.58E-04	2.7
1135.27753	-1.	3 2 1	3 3 0	1.01E-04	7.	1.01E-04	.2
1135.73681	-19.	2 0 2	3 1 3	4.21E-04	11.	4.76E-04	-12.3
1137.66921	-3.	4 2 2	4 3 1	3.03E-04	11.	3.04E-04	-.4
1138.16441	-11.	5 0 5	5 1 4	1.78E-04	2.	1.71E-04	4.2
1139.87366	3.	3 1 3	3 2 2	3.03E-04	6.	3.11E-04	-2.5
1140.90285	0.	5 2 3	5 3 2	1.72E-04	5.	1.72E-04	.1
1141.86367	5.	5 3 3	6 2 4	3.93E-05	6.	3.96E-05	-.7
1143.98057	12.	6 2 4	6 3 3	3.50E-04	10.	3.34E-04	4.8
1145.19364	17.	8 2 6	8 3 5	2.03E-04	3.	2.02E-04	.3
1145.71621	-2.	7 2 5	7 3 4	1.45E-04	5.	1.40E-04	3.4
1147.27700	3.	3 2 2	4 1 3	9.98E-05	5.	9.99E-05	-.1
1147.34444	11.	6 1 5	6 2 4	4.23E-04	5.	4.27E-04	-.9
1148.06236	-1.	4 0 4	4 1 3	4.79E-04	1.	4.65E-04	3.0
1151.17206	-1.	2 1 1	2 2 0	3.13E-04	3.	3.03E-04	3.2
1152.87194	6.	3 1 2	3 2 1	2.53E-04	4.	2.54E-04	-.6
1153.98980	0.	0 0 0	1 1 1	2.96E-04	4.	3.04E-04	-2.7
1159.43547	0.	1 1 1	2 0 2	1.76E-04	2.	1.77E-04	-.4
1160.75551	24.	2 0 2	2 1 1	5.95E-04	4.	5.98E-04	-.4
1172.53656	-14.	4 3 1	5 2 4	2.43E-05	16.	2.26E-05	7.4
1175.69412	5.	3 1 3	2 2 0	2.91E-05	8.	3.07E-05	-5.3
1180.07047	-7.	4 1 4	3 2 1	1.64E-05	5.	1.84E-05	-11.4
1180.64512	3.	5 1 5	4 2 2	2.31E-05	17.	2.54E-05	-9.3
1181.07908	11.	4 2 3	3 3 0	1.42E-05	12.	1.25E-05	13.1
1187.31261	6.	4 2 2	3 3 1	2.63E-05	10.	2.74E-05	-3.9
1188.77249	2.	2 1 1	2 0 2	5.38E-04	1.	5.29E-04	1.8
1189.83624	0.	2 0 2	1 1 1	2.01E-04	6.	2.10E-04	-4.2
1194.12143	-5.	3 1 2	3 0 3	2.43E-04	2.	2.41E-04	.7
1195.24237	0.	1 1 1	0 0 0	3.05E-04	2.	3.01E-04	1.4
1201.49412	4.	4 2 2	4 1 3	4.76E-04	2.	4.68E-04	1.6
1201.55541	-3.	3 2 1	3 1 2	2.09E-04	5.	2.00E-04	4.2
1202.10640	2.	4 1 3	4 0 4	3.57E-04	3.	3.60E-04	-.8
1202.59990	12.	3 0 3	2 1 2	2.04E-04	11.	2.15E-04	-5.2
1203.03755	1.	2 2 0	2 1 1	2.36E-04	6.	2.39E-04	-1.3
1203.23022	0.	7 2 6	6 3 3	2.87E-05	3.	2.99E-05	-4.2
1203.75476	0.	5 2 3	5 1 4	2.06E-04	2.	2.12E-04	-2.8
1204.04461	-25.	5 2 3	4 3 2	2.79E-05	2.	2.66E-05	4.7
1207.50923	-3.	4 1 3	3 2 2	1.50E-04	4.	1.42E-04	5.7

Table 5. continued

observed position	o-c	upper J K _a K _c	lower J K _a K _c	observed strength	t _s	computed strength	(o-c) %
1207.57559	5.	7 3 5	6 4 2	2.46E-05	5.	2.64E-05	-7.1
1208.92613	35.	6 2 4	6 1 5	3.00E-04	4.	3.09E-04	-3.1
1209.89450	1.	2 2 1	2 1 2	8.43E-05	9.	8.60E-05	-2.0
1212.42180	0.	5 1 4	5 0 5	1.23E-04	7.	1.21E-04	1.7
1213.29444	-3.	3 1 3	2 0 2	5.53E-04	2.	5.57E-04	-.6
1213.88671	14.	3 2 2	3 1 3	2.55E-04	13.	2.28E-04	11.0
1214.67197	0.	4 0 4	3 1 3	6.10E-04	2.	6.07E-04	.5
1217.20562	2.	7 2 5	7 1 6	9.51E-05	6.	9.60E-05	-.9
1217.71746	10.	8 3 6	7 4 3	1.20E-05	1.	1.13E-05	5.7
1218.41776	7.	7 3 4	7 2 5	9.46E-05	6.	9.34E-05	1.3
1219.25968	-12.	4 2 3	4 1 4	1.11E-04	2.	1.11E-04	.0
1219.68977	2.	6 3 3	6 2 4	2.22E-04	2.	2.22E-04	.2
1219.79619	1.	8 3 5	8 2 6	1.32E-04	3.	1.33E-04	-.7
1222.02089	-16.	6 2 4	5 3 3	7.81E-05	7.	7.02E-05	10.6
1224.16437	-4.	6 1 5	6 0 6	1.47E-04	1.	1.57E-04	-6.4
1225.64538	4.	4 3 1	4 2 2	2.00E-04	3.	2.00E-04	-.1
1225.80405	8.	5 0 5	4 1 4	3.42E-04	5.	3.49E-04	-2.1
1225.93620	39.	5 2 4	5 1 5	1.71E-04	7.	1.84E-04	-7.1
1228.19062	0.	8 2 6	8 1 7	1.06E-04	8.	1.07E-04	-1.3
1229.20510	-2.	2 2 1	1 1 0	1.71E-04	4.	1.75E-04	-2.5
1229.47032	-8.	5 1 5	4 0 4	7.29E-04	1.	7.18E-04	1.6
1231.50773	6.	4 3 2	4 2 3	9.25E-05	5.	9.14E-05	1.2
1232.11852	1.	2 2 0	1 1 1	2.92E-04	4.	3.04E-04	-4.1
1233.73750	-4.	6 2 5	6 1 6	6.36E-05	6.	6.81E-05	-6.9
1233.80497	4.	5 3 3	5 2 4	1.80E-04	9.	1.85E-04	-2.8
1236.12848	0.	6 0 6	5 1 5	7.08E-04	1.	7.01E-04	1.0
1237.34668	-10.	6 3 4	6 2 5	8.58E-05	15.	7.83E-05	9.2
1237.98220	0.	6 1 6	5 0 5	3.35E-04	7.	3.53E-04	-5.3
1238.90485	1.	3 2 2	2 1 1	3.42E-04	5.	3.47E-04	-1.5
1239.27960	-4.	6 1 5	5 2 4	2.61E-04	2.	2.50E-04	4.2
1240.91370	0.	9 2 7	9 1 8	2.80E-05	5.	2.86E-05	-2.2
1242.25337	1.	7 3 5	7 2 6	1.15E-04	7.	1.16E-04	-.9
1245.89244	4.	7 0 7	6 1 6	3.26E-04	2.	3.17E-04	2.6
1246.77914	-11.	7 1 7	6 0 6	6.41E-04	2.	6.37E-04	.7
1247.35717	30.	4 2 3	3 1 2	1.58E-04	6.	1.71E-04	-7.9
1247.63339	3.	7 4 3	7 3 4	4.37E-05	6.	4.36E-05	.2
1248.11397	-6.	8 1 7	8 0 8	6.00E-05	8.	6.17E-05	-2.8
1248.47424	-3.	3 2 1	2 1 2	1.13E-04	6.	1.10E-04	2.3
1251.00623	-32.	6 4 2	6 3 3	9.62E-05	8.	1.00E-04	-3.8
1253.76372	-5.	7 1 6	6 2 5	1.38E-04	25.	1.29E-04	6.9
1254.48610	0.	4 4 1	4 3 2	3.25E-05	29.	3.55E-05	-8.8
1254.60658	-3.	5 4 2	5 3 3	9.20E-05	7.	9.80E-05	-6.3
1255.05441	3.	6 4 3	6 3 4	5.05E-05	4.	4.87E-05	3.6
1255.29487	9.	8 0 8	7 1 7	5.33E-04	2.	5.30E-04	.5
1255.70481	0.	8 1 8	7 0 7	2.69E-04	2.	2.65E-04	1.3
1255.99895	13.	9 3 7	9 2 8	4.24E-05	9.	4.72E-05	-10.8
1256.12236	-34.	7 4 4	7 3 5	8.12E-05	6.	8.15E-05	-.4
1259.34840	-17.	8 2 6	7 3 5	7.08E-05	5.	7.56E-05	-6.6
1259.37733	0.	9 1 8	9 0 9	1.96E-05	18.	1.84E-05	6.2
1261.29042	-8.	9 4 6	9 3 7	4.10E-05	11.	3.96E-05	3.5
1261.35358	31.	9 2 8	9 1 9	3.46E-05	12.	3.63E-05	-4.8
1261.48572	-10.	6 2 5	5 1 4	1.55E-04	3.	1.56E-04	-.6
1264.45715	0.	9 0 9	8 1 8	2.00E-04	5.	2.06E-04	-3.1
1264.64300	-6.	9 1 9	8 0 8	4.21E-04	4.	4.13E-04	1.9
1266.04481	1.	3 3 1	2 2 0	3.75E-04	4.	3.72E-04	.7
1266.58151	0.	3 3 0	2 2 1	1.74E-04	32.	1.85E-04	-6.1
1266.84288	10.	8 1 7	7 2 6	2.34E-04	5.	2.32E-04	1.0
1268.10360	-8.	4 2 2	3 1 3	1.17E-04	9.	1.34E-04	-13.5
1268.17558	3.	7 2 6	6 1 5	2.83E-04	8.	2.82E-04	.3
1273.44388	-2.	10 0 10	9 1 9	3.04E-04	2.	3.01E-04	.9
1277.20965	-3.	4 3 2	3 2 1	1.47E-04	6.	1.53E-04	-4.2
1277.89678	16.	8 5 3	8 4 4	3.04E-05	9.	3.27E-05	-7.3
1279.87353	0.	4 3 1	3 2 2	2.97E-04	5.	2.95E-04	.7
1280.20969	3.	6 5 1	6 4 2	4.28E-05	9.	4.27E-05	.3
1281.05252	-14.	11 2 10	11 1 11	1.27E-05	4.	1.16E-05	9.5
1286.91376	19.	5 3 3	4 2 2	2.38E-04	4.	2.43E-04	-2.1

Table 5. continued

observed position	o-c	upper J K _a K _c	lower J K _a K _c	observed strength	±s	computed strength	(o-c)±
1289.51483	0.	10 1 9	9 2 8	1.45E-04	2.	1.37E-04	5.6
1291.39436	15.	5 2 3	4 1 4	3.24E-05	3.	3.50E-05	-7.7
1291.98525	0.	10 2 9	9 1 8	7.08E-05	5.	6.88E-05	2.8
1294.97076	13.	6 3 4	5 2 3	8.74E-05	10.	9.40E-05	-7.3
1299.59295	0.	13 0 13	12 1 12	4.21E-05	6.	4.12E-05	2.1
1299.60054	0.	13 1 13	12 0 12	8.58E-05	3.	8.25E-05	4.0
1299.75786	0.	11 1 10	10 2 9	5.01E-05	16.	4.66E-05	7.1
1301.00990	0.	11 2 10	10 1 9	9.41E-05	6.	9.34E-05	.7
1301.58663	5.	7 3 5	6 2 4	1.44E-04	1.	1.44E-04	.3
1303.65477	15.	4 4 1	3 3 0	1.41E-04	3.	1.47E-04	-3.9
1307.18055	10.	8 3 6	7 2 5	5.48E-05	11.	5.42E-05	1.1
*1308.06648	0.	14 0 14	13 1 13	6.80E-05	5.	7.20E-05	-5.7
1311.62511	5.	6 3 3	5 2 4	1.32E-04	3.	1.34E-04	-1.8
1312.31680	29.	9 3 7	8 2 6	8.07E-05	5.	8.06E-05	.2
1315.76865	3.	5 4 2	4 3 1	2.29E-04	3.	2.26E-04	1.4
1319.49666	0.	13 2 12	12 1 11	3.70E-05	7.	3.55E-05	4.1
1327.25199	-1.	6 4 3	5 3 2	8.32E-05	4.	8.23E-05	1.0
1329.04700	-15.	6 4 2	5 3 3	1.53E-04	5.	1.63E-04	-6.2
1337.52161	6.	7 4 4	6 3 3	1.12E-04	11.	1.13E-04	-1.0
1342.17991	1.	5 5 1	4 4 0	1.81E-04	6.	1.78E-04	1.6
1342.59191	-2.	7 4 3	6 3 4	5.16E-05	5.	5.44E-05	-5.2
1354.62612	-4.	6 5 1	5 4 2	1.19E-04	7.	1.30E-04	-8.6
1357.53987	11.	8 4 4	7 3 5	7.03E-05	6.	6.59E-05	6.5
1366.75721	0.	7 5 3	6 4 2	1.01E-04	23.	8.94E-05	12.2
*1381.39253	-132.	6 6 0	5 5 1	1.41E-04	5.	1.30E-04	8.1
1389.39421	4.	9 5 5	8 4 4	3.33E-05	3.	3.54E-05	-6.1

line positions in cm^{-1} o-c, observed minus computed line positions $\times 10^5$. The computed values are derived from the energy levels given in Table 2

±s are the estimated uncertainties in the measured line strengths in percent.

(o-c)±, observed minus computed line strength values given in percent. Computed values are derived from constants obtained in this work and given in Table 4

*asterisks denote doubled absorptions with the quantum assignment given for the stronger transition. The strength given represents the sum of the strengths of the two comparable transitions.

Strengths normalized to 99.9% D_2^{16}O of which 0.037% is D_2^{17}O .

Table 6. Line positions and strengths (cm⁻²/atm. at 296K) of the (020)-(010) band of D₂¹⁶O

observed position	o-c	upper J K _a K _c	lower J K _a K _c	observed strength	ts	computed strength	(o-c)%	Z1 ^a	Z2 ^a	Z3 ^a
864.24096	67.	11 2 10	12 3 9	3.13E-05	10.	2.52E-05	19.6	4.92E-03	9.65E-05	1.41E-06
883.98992	-6.	9 1 9	10 2 8	5.72E-05	13.	4.85E-05	15.2	6.83E-03	1.30E-04	1.47E-06
884.31794	77.	9 1 8	10 4 7	2.92E-05	18.	2.57E-05	11.9	-4.97E-03	-9.97E-05	-1.08E-06
898.20494	26.	10 2 9	11 3 8	3.27E-05	18.	2.92E-05	10.8	5.29E-03	1.08E-04	1.05E-06
900.66170	21.	8 0 8	9 3 7	7.10E-05	4.	7.28E-05	-2.5	-8.37E-03	-1.62E-04	-1.50E-06
903.82573	17.	8 1 7	9 4 6	7.20E-05	2.	6.90E-05	4.2	-8.14E-03	-1.66E-04	-1.40E-06
912.68445	45.	11 3 9	12 4 8	5.55E-05	6.	5.24E-05	5.6	7.08E-03	1.58E-04	1.56E-06
918.49966	52.	8 1 8	9 2 7	5.32E-05	15.	4.71E-05	11.5	6.73E-03	1.32E-04	9.86E-07
920.20603	44.	7 1 6	8 4 5	4.61E-05	10.	3.69E-05	20.0	-5.95E-03	-1.23E-04	-8.31E-07
920.86870	-4.	12 6 6	13 7 7	2.85E-05	3.	2.83E-05	.9	5.17E-03	1.45E-04	3.78E-06
923.42990	20.	12 5 8	13 6 7	2.00E-05	0.	1.91E-05	4.6	4.25E-03	1.11E-04	3.08E-06
927.80027	0.	7 0 7	8 3 6	5.50E-05	5.	5.74E-05	-4.4	-7.43E-03	-1.47E-04	-9.71E-07
928.70918	-5.	12 5 7	13 6 8	3.54E-05	9.	3.88E-05	-9.6	6.07E-03	1.59E-04	2.83E-06
• 930.04293	9.	11 8 4	12 9 3	3.66E-05	13.	3.10E-05	15.2	5.38E-03	1.88E-04	6.73E-06
930.71439	7.	9 2 8	10 3 7	1.45E-04	6.	1.36E-04	6.5	1.14E-02	2.40E-04	1.50E-06
932.45136	-16.	11 6 6	12 7 5	5.64E-05	6.	6.22E-05	-10.2	7.66E-03	2.18E-04	4.92E-06
932.60620	0.	11 6 5	12 7 6	2.80E-05	4.	3.10E-05	-10.8	5.41E-03	1.54E-04	2.97E-06
933.57996	13.	6 1 5	7 4 4	6.73E-05	2.	6.06E-05	10.0	-7.62E-03	-1.58E-04	-8.96E-07
935.90271	43.	11 4 8	12 5 7	8.91E-05	5.	9.04E-05	-1.5	9.28E-03	2.28E-04	2.29E-06
936.28576	0.	11 5 7	12 6 6	9.31E-05	5.	8.69E-05	6.7	9.08E-03	2.40E-04	3.29E-06
938.64502	62.	11 5 6	12 6 7	4.22E-05	5.	4.37E-05	-3.5	6.43E-03	1.72E-04	2.31E-06
939.06680	28.	10 3 8	11 4 7	7.50E-05	3.	6.83E-05	8.9	8.08E-03	1.85E-04	1.24E-06
• 942.29985	-11.	10 8 2	11 9 3	7.11E-05	12.	6.33E-05	10.9	7.67E-03	2.77E-04	6.79E-06
944.53280	-30.	10 6 5	11 7 4	6.87E-05	8.	6.41E-05	6.7	7.78E-03	2.24E-04	3.21E-06
944.58132	-3.	10 6 4	11 7 5	1.54E-04	15.	1.28E-04	16.8	1.10E-02	3.16E-04	4.44E-06
948.68408	22.	10 5 6	11 6 5	8.53E-05	7.	9.16E-05	-7.4	9.32E-03	2.48E-04	2.50E-06
949.63083	5.	10 5 5	11 6 6	1.76E-04	4.	1.84E-04	-4.3	1.32E-02	3.52E-04	3.52E-06
951.91711	0.	10 4 7	11 5 6	1.04E-04	5.	1.04E-04	.1	9.94E-03	2.47E-04	1.83E-06
951.98704	0.	12 4 8	13 5 9	4.48E-05	16.	4.46E-05	.5	6.50E-03	1.70E-04	2.15E-06
952.55234	16.	7 1 7	8 2 6	1.83E-04	3.	1.84E-04	-.7	1.33E-02	2.67E-04	1.23E-06
952.95364	7.	6 0 6	7 3 5	1.63E-04	8.	1.60E-04	1.7	-1.24E-02	-2.50E-04	-1.16E-06
• 954.63050	-1.	9 8 2	10 9 1	1.22E-04	6.	1.22E-04	.3	1.06E-02	3.95E-04	5.88E-06
• 954.69287	-51.	9 7 3	10 8 2	2.25E-04	7.	2.23E-04	.8	1.45E-02	4.81E-04	4.89E-06
956.70350	15.	9 6 4	10 7 3	2.38E-04	2.	2.49E-04	-4.6	1.53E-02	4.47E-04	4.39E-06
956.71650	25.	9 6 3	10 7 4	1.18E-04	3.	1.24E-04	-5.1	1.08E-02	3.16E-04	3.10E-06
960.84136	25.	8 2 7	9 3 6	1.64E-04	1.	1.58E-04	3.9	1.23E-02	2.65E-04	1.01E-06
960.91064	24.	9 5 5	10 6 4	3.68E-04	3.	3.61E-04	2.0	1.85E-02	4.95E-04	3.63E-06
961.24293	18.	9 5 4	10 6 5	1.74E-04	4.	1.80E-04	-3.7	1.31E-02	3.51E-04	2.56E-06
962.57703	0.	10 4 6	11 5 7	2.25E-04	3.	2.19E-04	2.8	1.44E-02	3.67E-04	2.66E-06
966.13834	26.	9 4 6	10 5 5	4.36E-04	2.	4.33E-04	-.7	2.03E-02	5.06E-04	2.76E-06
* 967.02358	0.	8 8 0	9 9 1	2.37E-04	4.	2.22E-04	6.3	1.44E-02	5.48E-04	3.83E-06
• 968.96215	-77.	8 6 2	9 7 3	7.16E-04	5.	6.82E-04	4.8	2.54E-02	7.49E-04	4.89E-06
971.13321	-3.	9 4 5	10 5 6	2.13E-04	4.	2.21E-04	-3.7	1.45E-02	3.66E-04	1.97E-06
973.12000	21.	8 5 4	9 6 3	3.13E-04	4.	3.32E-04	-6.2	1.77E-02	4.77E-04	2.47E-06
973.21877	18.	8 5 3	9 6 4	6.43E-04	3.	6.65E-04	-3.3	2.51E-02	6.75E-04	3.49E-06
975.65611	0.	5 0 5	6 3 4	9.43E-05	10.	9.24E-05	2.0	-9.42E-03	-1.92E-04	-6.28E-07
979.28783	11.	8 4 5	9 5 4	4.01E-04	3.	4.13E-04	-3.0	1.98E-02	4.95E-04	1.95E-06
• 979.44617	17.	7 7 1	8 8 0	7.08E-04	2.	7.10E-04	-.2	2.58E-02	8.69E-04	2.99E-06
• 981.28990	60.	7 6 2	8 7 1	1.41E-03	11.	1.18E-03	16.5	3.33E-02	9.93E-04	3.94E-06
981.29547	41.	8 3 6	9 4 5	3.37E-04	2.	3.65E-04	-8.2	1.87E-02	4.37E-04	1.38E-06
981.33177	16.	8 4 4	9 5 5	8.01E-04	4.	8.31E-04	-3.8	2.81E-02	7.06E-04	2.77E-06
• 984.61889	0.	16 0 16	17 1 17	6.12E-05	5.	6.31E-05	-3.1	7.95E-03	-6.02E-06	3.35E-07
985.16807	10.	6 1 6	7 2 5	1.92E-04	5.	1.83E-04	4.5	1.33E-02	2.72E-04	7.15E-07
985.37738	-6.	7 5 3	8 6 2	1.10E-03	3.	1.15E-03	-4.5	3.30E-02	8.93E-04	3.06E-06
985.40116	24.	7 5 2	8 6 3	5.52E-04	3.	5.75E-04	-4.2	2.33E-02	6.31E-04	2.18E-06
987.82856	-76.	10 1 9	10 4 6	2.25E-05	20.	2.00E-05	11.3	4.38E-03	8.39E-05	1.74E-06
987.84076	16.	7 2 6	8 3 5	7.57E-04	2.	7.12E-04	5.9	2.61E-02	5.72E-04	1.33E-06
989.58831	34.	12 3 9	13 4 10	5.92E-05	8.	6.16E-05	-4.1	7.64E-03	2.05E-04	2.05E-06
990.73747	0.	11 3 8	12 4 9	6.46E-05	1.	6.20E-05	4.0	7.67E-03	2.00E-04	1.47E-06
991.89596	0.	7 4 4	8 5 3	1.43E-03	2.	1.45E-03	-1.4	3.71E-02	9.31E-04	2.55E-06
992.53494	26.	10 3 7	11 4 8	2.48E-04	3.	2.44E-04	1.6	1.52E-02	3.87E-04	2.09E-06
992.60548	20.	7 4 3	8 5 4	7.15E-04	2.	7.29E-04	-2.0	2.63E-02	6.60E-04	1.81E-06
• 993.67309	1.	6 6 0	7 7 1	1.88E-03	3.	1.91E-03	-1.6	4.24E-02	1.28E-03	2.49E-06
• 995.12603	-60.	15 1 15	16 0 16	1.40E-04	6.	1.35E-04	3.5	-1.16E-02	-4.87E-05	-2.69E-07
995.60874	3.	9 3 6	10 4 7	2.37E-04	5.	2.33E-04	1.6	1.49E-02	3.70E-04	0.00E+00

table 6 continued

observed position	o-c	upper			lower			observed strength	χ^2	computed strength	(o-c)%	z1 ^a	z2 ^a	z3 ^a
		J	K _a	K _c	J	K _a	K _c							
* 997.69975	-112.	6	5	1	7	6	2	3.02E-03	10.	2.81E-03	7.1	5.16E-02	1.40E-03	2.93E-06
997.82187	15.	7	3	5	8	4	4	1.47E-03	3.	1.42E-03	3.1	3.69E-02	8.67E-04	1.89E-06
999.96734	0.	15	1	15	15	2	14	4.66E-05	0.	4.89E-05	-5.0	-7.01E-03	1.25E-05	6.06E-07
1000.00623	-2.	15	0	15	15	1	14	2.29E-05	5.	2.45E-05	-6.9	-4.96E-03	1.33E-05	-4.77E-07
1000.46925	0.	8	3	5	9	4	6	8.91E-04	4.	8.67E-04	2.7	2.87E-02	6.98E-04	2.04E-06
1003.24185	-15.	14	2	12	15	3	13	2.80E-05	9.	2.92E-05	-4.4	5.52E-03	-1.14E-04	-7.17E-07
1004.29048	5.	6	4	3	7	5	2	1.19E-03	1.	1.20E-03	-7	3.38E-02	8.44E-04	1.52E-06
1004.48882	11.	6	4	2	7	5	3	2.28E-03	2.	2.39E-03	-4.6	4.76E-02	1.20E-03	2.15E-06
*1005.56694	137.	14	0	14	15	1	15	2.81E-04	6.	2.71E-04	3.4	1.65E-02	-1.79E-05	4.87E-07
1006.66475	14.	14	1	13	15	2	14	7.92E-05	14.	7.18E-05	9.4	8.49E-03	-1.14E-05	-8.76E-07
1007.42207	-2.	7	3	4	8	4	5	7.47E-04	4.	7.68E-04	-2.7	2.71E-02	6.47E-04	1.36E-06
*1010.06792	0.	5	5	1	6	6	0	4.13E-03	1.	4.32E-03	-4.5	6.40E-02	1.75E-03	1.81E-06
1011.25455	4.	6	2	5	7	3	4	7.82E-04	2.	7.54E-04	3.5	2.69E-02	5.96E-04	8.57E-07
1011.82065	-7.	14	0	14	14	1	13	1.01E-04	2.	9.74E-05	3.6	-9.92E-03	5.70E-05	7.29E-07
1012.33470	0.	6	3	4	7	4	3	1.32E-03	6.	1.25E-03	5.6	3.45E-02	8.11E-04	1.20E-06
1013.44397	7.	8	1	7	8	4	4	7.60E-05	25.	6.16E-05	19.0	7.69E-03	1.58E-04	0.00E+00
1015.40818	11.	5	1	5	6	2	4	7.72E-04	2.	7.43E-04	3.7	2.67E-02	5.59E-04	7.92E-07
1015.94667	34.	13	1	13	14	0	14	3.42E-04	13.	3.62E-04	-5.9	-1.86E-02	-4.25E-04	-3.44E-06
1016.26506	-1.	13	2	12	14	1	13	1.67E-04	15.	1.50E-04	10.0	-1.20E-02	-2.98E-04	-2.33E-06
1016.42484	-6.	6	3	3	7	4	4	2.58E-03	4.	2.56E-03	.9	4.94E-02	1.17E-03	1.70E-06
1016.63812	16.	5	4	2	6	5	1	3.51E-03	3.	3.68E-03	-4.8	5.92E-02	1.48E-03	1.58E-06
1016.67825	5.	5	4	1	6	5	2	1.81E-03	4.	1.84E-03	-1.6	4.18E-02	1.05E-03	1.12E-06
1021.86850	17.	11	2	9	12	3	10	1.13E-04	9.	1.17E-04	-3.5	1.05E-02	2.75E-04	1.88E-06
1024.99127	5.	12	1	11	13	2	12	2.85E-04	5.	2.86E-04	-.3	1.65E-02	4.11E-04	2.84E-06
1025.64253	2.	5	3	3	6	4	2	3.86E-03	5.	3.96E-03	-2.6	6.15E-02	1.44E-03	1.36E-06
1025.68746	19.	12	2	11	13	1	12	1.39E-04	6.	1.43E-04	-2.8	-1.17E-02	-2.91E-04	-2.03E-06
1026.01356	-8.	12	3	10	13	2	11	5.60E-05	5.	6.29E-05	-12.3	-7.72E-03	-2.08E-04	-2.03E-06
1026.03038	2.	10	2	8	11	3	9	4.07E-04	6.	4.04E-04	.7	1.96E-02	5.02E-04	2.63E-06
1026.23301	11.	12	0	12	13	1	13	6.25E-04	8.	6.62E-04	-5.8	2.51E-02	5.76E-04	4.27E-06
1026.25280	4.	12	1	12	13	0	13	3.36E-04	4.	3.31E-04	1.6	-1.78E-02	-4.07E-04	-3.02E-06
1027.05206	-8.	5	3	2	6	4	3	1.88E-03	2.	2.00E-03	-6.4	4.37E-02	1.03E-03	9.60E-07
1029.40664	15.	9	2	7	10	3	8	3.31E-04	4.	3.33E-04	-.6	1.78E-02	4.46E-04	1.75E-06
1031.06824	1.	5	2	4	6	3	3	2.85E-03	2.	2.86E-03	-5	5.23E-02	1.17E-03	1.06E-06
1032.57443	-17.	8	2	6	9	3	7	1.10E-03	3.	1.06E-03	3.6	3.18E-02	7.77E-04	2.22E-06
1033.86166	-2.	11	1	10	12	2	11	2.52E-04	4.	2.56E-04	-1.7	1.56E-02	3.89E-04	2.37E-06
1035.04820	15.	12	1	12	12	2	11	1.66E-04	2.	1.77E-04	-6.3	-1.30E-02	-2.47E-04	-1.83E-06
1035.34612	-9.	12	0	12	12	1	11	3.33E-04	3.	3.54E-04	-6.3	-1.85E-02	-3.49E-04	-2.57E-06
1036.20153	6.	7	2	5	8	3	6	8.04E-04	3.	8.26E-04	-2.7	2.81E-02	6.68E-04	1.36E-06
1036.44816	-17.	11	0	11	12	1	12	5.68E-04	4.	5.75E-04	-1.2	2.34E-02	5.38E-04	3.62E-06
1037.16274	-17.	11	3	9	12	2	10	2.43E-04	13.	2.25E-04	7.5	-1.46E-02	-3.92E-04	-3.21E-06
1038.34237	-2.	4	3	2	5	4	1	2.84E-03	1.	2.90E-03	-2.2	5.26E-02	1.23E-03	6.54E-07
1038.69874	-2.	4	3	1	5	4	2	5.49E-03	1.	5.81E-03	-5.9	7.45E-02	1.75E-03	9.26E-07
1040.87404	-8.	6	2	4	7	3	5	2.51E-03	2.	2.50E-03	.3	4.89E-02	1.14E-03	1.60E-06
1042.38746	-7.	10	1	9	11	2	10	8.30E-04	4.	8.70E-04	-4.8	2.88E-02	7.11E-04	3.77E-06
1042.53128	-15.	4	1	4	5	2	3	7.68E-04	3.	7.48E-04	2.6	2.68E-02	5.67E-04	4.36E-07
1042.86999	-11.	14	1	13	14	2	12	7.78E-05	17.	9.21E-05	-18.4	-9.71E-03	1.09E-04	0.00E+00
1044.84382	-9.	10	2	9	11	1	10	4.31E-04	4.	4.34E-04	-.7	-2.03E-02	-5.05E-04	-2.77E-06
1046.57231	1.	10	0	10	11	1	11	1.82E-03	1.	1.89E-03	-4.1	4.25E-02	9.75E-04	5.92E-06
1046.65784	0.	10	1	10	11	0	11	9.17E-04	1.	9.45E-04	-3.1	-3.00E-02	-6.90E-04	-4.20E-06
1047.04362	-11.	5	2	3	6	3	4	1.80E-03	3.	1.84E-03	-2.3	4.20E-02	9.61E-04	8.96E-07
1047.11691	5.	11	0	11	11	1	10	2.97E-04	4.	3.10E-04	-4.3	-1.73E-02	-3.32E-04	-1.83E-06
1047.80545	-3.	4	2	3	5	3	2	2.36E-03	1.	2.37E-03	-.5	4.76E-02	1.06E-03	0.008E+00
1048.27152	-33.	5	0	5	5	3	2	7.67E-05	4.	6.66E-05	13.2	7.99E-03	1.65E-04	0.00E+00
1049.78154	-17.	10	3	8	11	2	9	1.78E-04	10.	1.84E-04	-3.1	-1.32E-02	-3.54E-04	-2.49E-06
1050.38665	6.	9	1	8	10	2	9	6.88E-04	7.	6.92E-04	-.6	2.57E-02	6.28E-04	2.85E-06
1050.79356	6.	3	3	1	4	4	0	7.54E-03	1.	7.98E-03	-5.9	8.73E-02	2.05E-03	0.00E+00
1050.84425	-3.	3	3	0	4	4	1	3.81E-03	1.	3.99E-03	-4.8	6.17E-02	1.45E-03	0.00E+00
1051.78062	8.	13	2	12	13	3	11	2.04E-04	8.	1.93E-04	5.5	-1.36E-02	-2.81E-04	-1.76E-06
1054.05405	0.	13	1	12	13	2	11	9.65E-05	4.	9.81E-05	-1.6	-9.70E-03	-2.01E-04	-1.188E-06
1054.86024	-11.	9	2	8	10	1	9	1.33E-03	2.	1.38E-03	-3.4	-3.62E-02	-8.93E-04	-4.34E-06
1055.00645	3.	4	2	2	5	3	3	5.06E-03	2.	5.25E-03	-3.8	7.09E-02	1.60E-03	9.16E-07
1056.58950	-3.	9	0	9	10	1	10	1.40E-03	3.	1.48E-03	-5.4	3.75E-02	8.60E-04	4.66E-06
1056.76712	4.	9	1	9	10	0	10	2.81E-03	2.	2.94E-03	-4.7	-5.30E-02	-1.22E-03	-6.61E-06
1056.90808	15.	4	0	4	4	3	1	9.91E-05	10.	9.90E-05	.1	9.75E-03	2.03E-04	0.00E+00
1057.65088	-7.	8	1	7	9	2	8	2.06E-03	0.	2.06E-03	.2	4.43E-02	1.07E-03	4.02E-06
1058.97133	-2.	10	0	10	10	1	9	9.76E-04	5.	1.03E-03	-5.7	-3.15E-02	-6.15E-04	-2.41E-06
1060.42903	44.	11	4	8	12	3	9	7.42E-05	10.	7.49E-05	-1.0	-8.40E-03	-2.51E-04	-3.39E-06

table 6 continued

observed position	o-c	upper	lower	observed strength	%	computed strength	(o-c) %	z1 ^a	z2 ^a	z3 ^a
		J K _a K _c	J K _a K _c							
1061.70742	-6.	12 2 11	12 3 10	1.77E-04	2.	1.85E-04	-4.2	-1.33E-02	-2.78E-04	-1.30E-06
1062.34299	2.	3 2 2	4 3 1	6.57E-03	0.	6.93E-03	-5.5	8.14E-02	1.82E-03	0.00E+00
1064.05771	-1.	7 1 6	8 2 7	1.49E-03	3.	1.43E-03	4.3	3.69E-02	8.77E-04	2.64E-06
1064.79532	-4.	3 2 1	4 3 2	3.50E-03	2.	3.56E-03	-1.8	5.84E-02	1.31E-03	0.00E+00
1065.50286	-14.	8 2 7	9 1 8	9.87E-04	1.	1.01E-03	-1.9	-3.10E-02	-7.60E-04	-3.26E-06
1065.63197	0.	12 1 11	12 2 10	3.29E-04	15.	3.82E-04	-16.0	-1.91E-02	-4.01E-04	-1.65E-06
1066.05727	-4.	3 1 3	4 2 2	2.92E-03	1.	2.84E-03	2.8	5.22E-02	1.12E-03	0.00E+00
1066.47053	-2.	8 0 8	9 1 9	4.23E-03	2.	4.31E-03	-1.9	6.42E-02	1.47E-03	7.03E-06
1066.83769	-15.	8 1 8	9 0 9	2.07E-03	1.	2.16E-03	-4.1	-4.54E-02	-1.04E-03	-5.00E-06
1068.92216	2.	9 1 9	9 2 8	1.58E-03	5.	1.62E-03	-2.7	-3.95E-02	-7.82E-04	-2.15E-06
1069.75558	0.	6 1 5	7 2 6	3.70E-03	3.	3.72E-03	-5.	5.96E-02	1.39E-03	3.19E-06
1071.00985	3.	9 0 9	9 1 8	8.15E-04	2.	8.23E-04	-1.0	-2.81E-02	-5.59E-04	-1.43E-06
1071.22204	-6.	11 2 10	11 3 9	6.58E-04	6.	6.74E-04	-2.4	-2.54E-02	-5.38E-04	-1.81E-06
1074.36050	18.	13 3 11	13 4 10	1.41E-04	1.	1.54E-04	-9.1	-1.21E-02	-2.75E-04	-1.65E-06
1075.22849	-2.	5 1 4	6 2 5	2.34E-03	3.	2.31E-03	1.2	4.70E-02	1.08E-03	1.78E-06
1075.55796	3.	2 2 1	3 3 0	4.17E-03	5.	4.58E-03	-9.8	6.62E-02	1.48E-03	0.00E+00
1076.04555	-5.	2 2 0	3 3 1	8.76E-03	0.	9.21E-03	-5.1	9.39E-02	2.10E-03	0.00E+00
1076.16335	9.	7 0 7	8 1 8	2.82E-03	3.	2.97E-03	-5.4	5.33E-02	1.22E-03	5.04E-06
1076.52165	0.	14 2 12	14 3 11	7.14E-05	6.	8.11E-05	-13.6	-8.80E-03	-2.08E-04	1.04E-07
1076.91341	2.	7 1 7	8 0 8	5.57E-03	3.	5.94E-03	-6.7	-7.54E-02	-1.72E-03	-7.23E-06
1077.13393	-10.	7 2 6	8 1 7	2.59E-03	2.	2.68E-03	-3.3	-5.05E-02	-1.23E-03	-4.71E-06
1077.69147	-2.	11 1 10	11 2 9	3.46E-04	7.	3.56E-04	-2.8	-1.85E-02	-3.92E-04	-1.01E-06
*1078.63898	-80.	9 7 3	9 8 2	1.28E-04	37.	1.16E-04	9.0	-1.04E-02	-3.46E-04	-5.22E-06
*1078.71782	-39.	11 8 4	11 9 3	2.29E-05	2.	2.38E-05	-4.1	-4.71E-03	-1.64E-04	-6.53E-06
*1078.79496	-52.	10 8 2	10 9 1	2.82E-05	9.	3.12E-05	-10.6	-5.39E-03	-1.95E-04	-5.82E-06
*1078.89328	0.	9 8 2	9 9 1	2.46E-05	15.	2.91E-05	-18.3	-5.20E-03	-1.94E-04	-4.10E-06
1079.61423	4.	8 1 8	8 2 7	1.22E-03	3.	1.22E-03	.2	-3.42E-02	-6.88E-04	-1.18E-06
1080.12322	9.	10 2 9	10 3 8	5.65E-04	5.	5.81E-04	-2.8	-2.36E-02	-5.04E-04	-1.18E-06
*1080.37807	-8.	7 6 2	7 7 1	3.06E-04	5.	3.21E-04	-4.7	-1.74E-02	-5.22E-04	-3.46E-06
*1080.41414	-81.	8 6 2	8 7 1	3.97E-04	10.	3.83E-04	3.6	-1.90E-02	-5.62E-04	-5.05E-06
1080.46545	-13.	8 3 6	9 2 7	3.19E-04	7.	3.49E-04	-9.4	-1.82E-02	-4.86E-04	-2.88E-06
1080.68881	11.	10 6 5	10 7 4	7.52E-05	6.	7.88E-05	-4.8	-8.63E-03	-2.47E-04	-3.77E-06
1080.72786	16.	10 6 4	10 7 3	1.60E-04	15.	1.58E-04	1.4	-1.22E-02	-3.49E-04	-5.21E-06
1080.95405	-5.	11 6 6	11 7 5	9.53E-05	4.	1.01E-04	-6.2	-9.78E-03	-2.76E-04	-5.91E-06
1081.11157	-2.	4 1 3	5 2 4	5.51E-03	0.	5.52E-03	-.2	7.27E-02	1.64E-03	1.82E-06
1081.22624	0.	12 3 10	12 4 9	1.46E-04	8.	1.51E-04	-3.2	-1.20E-02	-2.74E-04	-1.26E-06
1083.34126	-1.	8 0 8	8 1 7	2.35E-03	1.	2.51E-03	-6.7	-4.91E-02	-9.91E-04	-1.42E-06
*1084.29136	-109.	6 5 1	6 6 0	9.06E-04	6.	8.44E-04	6.8	-2.83E-02	-7.73E-04	-2.75E-06
1084.39748	-22.	7 5 3	7 6 2	6.75E-04	4.	7.11E-04	-5.4	-2.60E-02	-7.03E-04	-3.36E-06
1084.41761	0.	7 5 2	7 6 1	3.60E-04	4.	3.56E-04	1.2	-1.84E-02	-4.96E-04	-2.38E-06
1084.59457	-11.	8 5 4	8 6 3	3.17E-04	5.	3.22E-04	-1.5	-1.75E-02	-4.68E-04	-2.89E-06
1084.67547	0.	8 5 3	8 6 2	6.27E-04	8.	6.43E-04	-2.6	-2.47E-02	-6.62E-04	-4.07E-06
1084.88337	11.	9 5 5	9 6 4	4.79E-04	3.	4.92E-04	-2.8	-2.16E-02	-5.74E-04	-4.40E-06
1085.14527	3.	9 5 4	9 6 3	2.26E-04	10.	2.47E-04	-9.2	-1.53E-02	-4.06E-04	-3.11E-06
1085.23859	-2.	10 5 6	10 6 5	1.79E-04	9.	1.68E-04	6.4	-1.26E-02	-3.32E-04	-3.12E-06
1085.57866	1.	6 0 6	7 1 7	7.28E-03	0.	7.66E-03	-5.2	8.56E-02	1.94E-03	6.83E-06
1085.59345	-30.	11 5 7	11 6 6	2.33E-04	18.	2.08E-04	10.9	-1.40E-02	-3.66E-04	-4.20E-06
1085.83195	-17.	12 5 8	12 6 7	6.39E-05	20.	5.89E-05	7.8	-7.48E-03	-1.95E-04	-4.02E-06
1085.87324	-7.	2 1 2	3 2 1	2.41E-03	2.	2.39E-03	.8	4.79E-02	1.03E-03	0.00E+00
1085.95486	-1.	10 5 5	10 6 4	3.18E-04	5.	3.35E-04	-5.4	-1.78E-02	-4.70E-04	-4.39E-06
1087.93538	-6.	3 1 2	4 2 3	3.07E-03	1.	3.19E-03	-3.8	5.52E-02	1.22E-03	8.20E-07
1088.19545	-20.	9 2 8	9 3 7	1.80E-03	3.	1.89E-03	-4.9	-4.25E-02	-9.18E-04	-1.43E-06
1088.44407	-18.	12 4 9	12 5 8	9.85E-05	2.	1.03E-04	-4.6	-9.90E-03	-2.42E-04	-1.79E-06
1088.61028	-34.	13 2 11	13 3 10	7.81E-05	11.	8.76E-05	-12.2	-9.15E-03	-2.11E-04	-7.50E-07
1089.74801	-4.	7 1 7	7 2 6	3.33E-03	5.	3.47E-03	-4.1	-5.77E-02	-1.18E-03	-1.10E-06
1090.10171	-3.	6 2 5	7 1 6	1.62E-03	8.	1.58E-03	2.2	-3.89E-02	-9.42E-04	-3.27E-06
1090.13194	-43.	10 1 9	10 2 8	1.24E-03	2.	1.27E-03	-2.7	-3.49E-02	-7.52E-04	-9.95E-07
1090.16151	-1.	11 4 8	11 5 7	3.68E-04	5.	3.72E-04	-1.0	-1.88E-02	-4.62E-04	-2.88E-06
1090.79635	3.	5 4 2	5 5 1	1.22E-03	3.	1.27E-03	-4.2	-3.48E-02	-8.74E-04	-1.45E-06
1090.83135	0.	5 4 1	5 5 0	6.23E-04	4.	6.34E-04	-1.7	-2.46E-02	-6.18E-04	-1.02E-06
1091.07881	-7.	10 4 7	10 5 6	2.79E-04	8.	3.10E-04	-11.0	-1.72E-02	-4.22E-04	0.00E+00
1091.12459	5.	6 4 2	6 5 1	1.65E-03	3.	1.69E-03	-2.5	-4.01E-02	-1.00E-03	-2.27E-06
1091.17622	-12.	7 4 4	7 5 3	1.58E-03	5.	1.62E-03	-2.4	-3.92E-02	-9.75E-04	-2.87E-06
1091.37349	-14.	8 4 5	8 5 4	6.17E-04	3.	6.55E-04	-6.2	-2.50E-02	-6.18E-04	-2.27E-06
1091.40754	16.	9 4 6	9 5 5	9.00E-04	2.	9.45E-04	-5.0	-3.00E-02	-7.40E-04	0.00E+00
1091.74667	0.	7 4 3	7 5 2	7.67E-04	6.	8.08E-04	-5.3	-2.77E-02	-6.91E-04	-2.02E-06
1091.78378	-1.	10 3 8	10 4 7	4.78E-04	9.	4.79E-04	-.3	-2.14E-02	-4.93E-04	-1.39E-06

table 6 continued

observed position	o-c	upper			lower			observed strength	ts	computed strength		(o-c)‡	z1 ^a	z2 ^a	z3 ^a
		J	K _a	K _c	J	K _a	K _c			t _s	strength				
1092.93823	5.	8	4	4	8	5	3	1.27E-03	2.	1.31E-03	-3.4	-3.54E-02	-8.78E-04	-3.18E-06	
1094.58693	1.	5	0	5	6	1	6	4.40E-03	1.	4.57E-03	-3.9	6.61E-02	1.49E-03	4.30E-06	
1095.22300	3.	8	2	7	8	3	6	1.40E-03	3.	1.43E-03	-2.2	-3.70E-02	-8.07E-04	-7.95E-07	
1095.31529	-21.	9	3	7	9	4	6	1.56E-03	3.	1.53E-03	2.0	-3.82E-02	-8.83E-04	-1.98E-06	
1095.97933	-9.	7	0	7	7	1	6	1.74E-03	2.	1.84E-03	-5.9	-4.21E-02	-8.63E-04	-4.70E-07	
1096.01794	-2.	2	1	1	3	2	2	6.92E-03	0.	7.11E-03	-2.8	8.25E-02	1.81E-03	5.55E-07	
1097.48119	-4.	5	1	5	6	0	6	8.59E-03	1.	9.05E-03	-5.3	-9.30E-02	-2.11E-03	-6.44E-06	
1098.15864	-4.	7	3	5	8	2	6	7.86E-04	4.	8.01E-04	-2.0	-2.76E-02	-7.38E-04	-4.28E-06	
1099.09837	26.	6	1	6	6	2	5	2.38E-03	1.	2.31E-03	2.8	-4.71E-02	-9.79E-04	-3.48E-07	
1099.17872	-8.	7	3	5	7	4	4	2.82E-03	1.	2.92E-03	-3.6	-5.28E-02	-1.23E-03	-1.73E-06	
1099.89527	-22.	6	3	4	6	4	3	1.67E-03	3.	1.71E-03	-2.2	-4.04E-02	-9.43E-04	-1.00E-06	
1100.13904	-16.	5	3	3	5	4	2	3.22E-03	2.	3.37E-03	-4.7	-5.67E-02	-1.33E-03	-9.92E-07	
1100.14889	-13.	4	3	2	4	4	1	1.14E-03	4.	1.20E-03	-5.7	-3.39E-02	-7.97E-04	0.00E+00	
1100.45651	2.	4	3	1	4	4	0	2.37E-03	2.	2.41E-03	-1.7	-4.80E-02	-1.13E-03	0.00E+00	
1101.03805	8.	7	2	6	7	3	5	3.94E-03	1.	4.02E-03	-2.0	-6.20E-02	-1.36E-03	-7.83E-07	
1101.29390	0.	5	3	2	5	4	1	1.67E-03	4.	1.70E-03	-1.6	-4.02E-02	-9.46E-04	-6.77E-07	
1102.38014	-4.	1	1	1	2	2	0	6.54E-03	6.	6.85E-03	-4.7	8.10E-02	1.76E-03	0.00E+00	
1102.46342	7.	9	1	8	9	2	7	1.07E-03	2.	1.12E-03	-4.4	-3.27E-02	-7.09E-04	-2.73E-07	
1103.06871	0.	4	0	4	5	1	5	1.01E-02	2.	1.00E-02	.5	9.80E-02	2.20E-03	4.93E-06	
1104.52056	-1.	5	2	4	6	1	5	3.03E-03	1.	3.22E-03	-6.3	-5.54E-02	-1.34E-03	-4.32E-06	
1105.49300	-2.	1	1	0	2	2	1	3.87E-03	1.	3.88E-03	-.4	6.10E-02	1.33E-03	0.00E+00	
1105.55490	-11.	6	2	5	6	3	4	2.46E-03	2.	2.56E-03	-4.1	-4.95E-02	-1.10E-03	-3.09E-07	
1106.00529	-13.	7	3	4	7	4	3	1.47E-03	3.	1.52E-03	-3.3	-3.81E-02	-8.97E-04	-1.04E-06	
1107.24553	32.	8	0	8	7	3	5	3.19E-05	7.	2.58E-05	19.0	4.98E-03	1.02E-04	1.44E-06	
1107.42227	3.	5	1	5	5	2	4	5.39E-03	1.	5.74E-03	-6.6	-7.42E-02	-1.56E-03	5.10E-08	
1107.76322	-4.	12	4	8	12	5	7	2.09E-04	7.	2.20E-04	-5.2	-1.45E-02	-3.69E-04	-2.12E-06	
1108.34695	-27.	4	1	4	5	0	5	4.40E-03	3.	4.84E-03	-10.1	-6.80E-02	-1.54E-03	-3.89E-06	
1108.63173	-5.	6	0	6	6	1	5	4.87E-03	0.	5.25E-03	-7.8	-7.10E-02	-1.48E-03	1.18E-07	
1108.79250	2.	5	2	4	5	3	3	5.48E-03	1.	5.78E-03	-5.4	-7.44E-02	-1.65E-03	-1.14E-07	
1111.07295	2.	3	0	3	4	1	4	4.94E-03	2.	5.05E-03	-2.2	6.95E-02	1.55E-03	2.50E-06	
1112.02795	0.	3	2	2	3	3	1	3.82E-03	5.	3.80E-03	.4	-6.03E-02	-1.35E-03	2.96E-07	
1113.78098	12.	8	1	7	8	2	6	3.80E-03	1.	3.75E-03	1.3	-5.99E-02	-1.31E-03	2.76E-07	
1114.07295	0.	3	2	1	3	3	0	1.83E-03	3.	1.94E-03	-6.3	-4.31E-02	-9.69E-04	2.46E-07	
1114.50611	1.	4	1	4	4	2	3	3.12E-03	0.	3.22E-03	-3.3	-5.56E-02	-1.18E-03	3.27E-07	
1114.58440	3.	9	3	6	9	4	5	8.36E-04	5.	8.67E-04	-3.7	-2.88E-02	-6.89E-04	-9.24E-07	
1118.37881	-12.	10	3	7	10	4	6	9.65E-04	15.	1.13E-03	-17.4	-3.29E-02	-7.99E-04	-1.10E-06	
1118.61618	0.	10	2	8	10	3	7	1.40E-03	2.	1.46E-03	-4.0	-3.73E-02	-8.68E-04	-1.32E-07	
1118.99156	-1.	2	0	2	3	1	3	9.15E-03	0.	9.35E-03	-2.2	9.46E-02	2.09E-03	2.13E-06	
1119.65943	-4.	5	2	3	5	3	2	3.19E-03	3.	3.34E-03	-4.6	-5.65E-02	-1.28E-03	2.21E-07	
1119.84367	-18.	12	3	9	12	4	8	3.22E-04	6.	3.50E-04	-8.6	-1.82E-02	-4.54E-04	-8.39E-07	
1119.93809	-3.	3	1	3	4	0	4	8.66E-03	0.	8.98E-03	-3.7	-9.27E-02	-2.09E-03	-4.27E-06	
1120.09049	2.	4	2	3	5	1	4	1.36E-03	3.	1.37E-03	-1.0	-3.62E-02	-8.75E-04	-2.68E-06	
1120.20187	5.	3	1	3	3	2	2	5.92E-03	1.	6.21E-03	-4.9	-7.71E-02	-1.66E-03	6.96E-07	
1120.38112	-29.	11	3	8	11	4	7	3.37E-04	4.	3.33E-04	1.2	-1.78E-02	-4.38E-04	-6.60E-07	
1120.55692	8.	5	0	5	5	1	4	3.56E-03	2.	3.64E-03	-2.2	-5.91E-02	-1.25E-03	5.50E-07	
1123.07000	-12.	7	1	6	7	2	5	2.85E-03	3.	3.00E-03	-5.2	-5.36E-02	-1.18E-03	5.95E-07	
1123.09996	-3.	6	2	4	6	3	3	6.07E-03	1.	6.49E-03	-6.8	-7.87E-02	-1.79E-03	3.13E-07	
1123.75287	-3.	9	2	7	9	3	6	1.26E-03	3.	1.28E-03	-1.4	-3.49E-02	-8.12E-04	8.98E-08	
1124.44524	4.	2	1	2	2	2	1	2.23E-03	3.	2.22E-03	.3	-4.62E-02	-1.00E-03	4.97E-07	
1125.96091	-4.	8	2	6	8	3	5	3.82E-03	3.	4.01E-03	-4.9	-6.19E-02	-1.43E-03	2.70E-07	
1127.46588	4.	1	0	1	2	1	2	3.88E-03	2.	3.98E-03	-2.5	6.17E-02	1.35E-03	6.56E-07	
1129.65860	-5.	6	1	5	6	2	4	8.43E-03	0.	8.74E-03	-3.7	-9.15E-02	-2.02E-03	1.21E-06	
1130.76425	0.	4	0	4	4	1	3	9.49E-03	0.	9.71E-03	-2.3	-9.65E-02	-2.06E-03	1.20E-06	
1131.95746	0.	2	1	1	2	2	0	5.73E-03	1.	5.91E-03	-3.2	-7.52E-02	-1.65E-03	9.01E-07	
1132.37655	5.	2	1	2	3	0	3	3.28E-03	0.	3.37E-03	-2.7	-5.67E-02	-1.28E-03	-2.02E-06	
1133.89088	-4.	3	1	2	3	2	1	4.78E-03	1.	4.98E-03	-4.2	-6.91E-02	-1.52E-03	8.38E-07	
1134.65512	-1.	4	1	3	4	2	2	1.10E-02	2.	1.18E-02	-7.3	-1.06E-01	-2.35E-03	1.34E-06	
1135.10514	-1.	5	3	3	6	2	4	7.26E-04	5.	7.41E-04	-2.0	-2.65E-02	-7.14E-04	-4.24E-06	
1137.04589	-5.	0	0	0	1	1	1	5.91E-03	0.	5.97E-03	-1.1	7.56E-02	1.65E-03	0.00E+00	
1138.50606	4.	3	0	3	3	1	2	5.84E-03	0.	5.88E-03	-.6	-7.50E-02	-1.62E-03	9.39E-07	
1140.03497	-9.	7	4	4	8	3	5	2.04E-04	11.	2.18E-04	-7.0	-1.43E-02	-4.48E-04	-5.25E-06	
1143.65730	0.	2	0	2	2	1	1	1.13E-02	2.	1.19E-02	-5.3	-1.07E-01	-2.32E-03	1.23E-06	
1145.39231	-2.	1	1	1	2	0	2	3.40E-03	1.	3.43E-03	-.9	-5.73E-02	-1.29E-03	-1.45E-06	
1147.69083	-10.	8	4	4	9	3	7	1.12E-04	16.	1.33E-04	-19.2	-1.12E-02	-3.67E-04	-5.87E-06	
1148.19206	-3.	9	5	5	10	4	6	4.31E-05	6.	4.87E-05	-13.0	-6.72E-03	-2.51E-04	-6.02E-06	
1149.65125	13.	7	1	7	6	2	4	1.45E-04	2.	1.21E-04	16.5	-1.08E-02	-2.31E-04	0.00E+00	
1152.21094	-3.	2	2	1	3	1	2	4.09E-04	4.	4.44E-04	-8.5	-2.06E-02	-4.97E-04	-1.31E-06	

table 6 continued

observed position	o-c	upper			lower			observed strength	%s	computed strength	(o-c)%	Z_1^a	Z_2^a	Z_3^a
		J	K _a	K _c	J	K _a	K _c							
1152.60072	7.	6	3	3	7	2	6	3.16E-04	3.	3.41E-04	-7.9	-1.79E-02	-5.18E-04	-5.14E-06
1152.94664	4.	4	3	2	5	2	3	2.66E-04	2.	2.82E-04	-5.9	-1.63E-02	-4.42E-04	-2.62E-06
1156.14140	8.	3	1	3	2	2	0	5.90E-04	14.	5.88E-04	-3.	-2.37E-02	-5.21E-04	5.78E-07
1156.17739	15.	7	4	3	8	3	6	8.22E-05	4.	9.40E-05	-14.4	-9.39E-03	-3.05E-04	-4.29E-06
1157.29336	-17.	6	1	6	5	2	3	1.30E-04	15.	1.28E-04	1.2	-1.11E-02	-2.41E-04	-3.33E-07
1157.70277	8.	5	3	2	6	2	5	2.18E-04	5.	2.28E-04	-4.8	-1.47E-02	-4.15E-04	-3.46E-06
1160.15436	-2.	4	2	3	3	3	0	2.43E-04	2.	2.31E-04	4.8	-1.49E-02	-3.42E-04	2.16E-07
1160.46154	-4.	4	1	4	3	2	1	3.81E-04	1.	3.52E-04	7.6	-1.84E-02	-4.02E-04	3.66E-07
1160.96574	-4.	5	1	5	4	2	2	5.54E-04	3.	4.86E-04	12.4	-2.16E-02	-4.71E-04	8.51E-08
1161.89691	-2.	5	3	3	4	4	0	2.73E-04	9.	2.35E-04	13.9	-1.50E-02	-3.67E-04	0.00E+00
1162.52859	-2.	4	2	2	5	1	5	3.44E-04	2.	3.73E-04	-8.4	-1.88E-02	-4.90E-04	-3.33E-06
1163.10047	-6.	5	3	2	4	4	1	1.09E-04	15.	1.19E-04	-8.8	-1.06E-02	-2.61E-04	0.00E+00
1163.29296	6.	3	2	1	4	1	4	2.64E-04	4.	2.61E-04	1.2	-1.57E-02	-3.97E-04	-2.01E-06
1165.28274	-16.	6	4	2	5	5	1	9.87E-05	5.	1.02E-04	-3.0	-9.82E-03	-2.60E-04	-8.15E-07
1165.67889	1.	4	3	1	5	2	4	4.15E-04	3.	4.49E-04	-8.2	-2.06E-02	-5.73E-04	-4.12E-06
1166.05280	-1.	4	2	2	3	3	1	5.02E-04	3.	5.05E-04	-5.	-2.20E-02	-5.10E-04	4.49E-07
1166.54485	5.	6	4	2	7	3	5	1.95E-04	3.	2.16E-04	-11.0	-1.42E-02	-4.59E-04	-5.82E-06
1169.55954	11.	3	3	1	4	2	2	3.01E-04	1.	2.92E-04	2.9	-1.66E-02	-4.52E-04	-2.57E-06
1170.15389	0.	5	2	4	4	3	1	7.86E-04	6.	7.68E-04	2.2	-2.71E-02	-6.28E-04	3.04E-07
1171.84155	3.	1	1	0	1	0	1	4.04E-03	1.	4.03E-03	-3.	-6.20E-02	-1.41E-03	0.00E+00
1172.46283	2.	3	1	2	2	2	1	6.37E-04	1.	6.09E-04	4.3	-2.41E-02	-5.43E-04	8.59E-07
1172.99761	2.	2	0	2	1	1	1	4.08E-03	1.	3.99E-03	2.2	-6.18E-02	-1.36E-03	1.93E-06
1173.49911	-9.	6	2	4	7	1	7	8.10E-05	14.	9.47E-05	-17.0	-9.46E-03	-2.70E-04	-3.35E-06
1174.13728	3.	6	3	4	5	4	1	2.09E-04	5.	2.08E-04	-5.	-1.41E-02	-3.48E-04	0.00E+00
1174.28402	-7.	5	4	2	6	3	3	1.90E-04	3.	1.97E-04	-3.7	-1.36E-02	-4.32E-04	-4.80E-06
1174.46949	-5.	10	2	9	9	3	6	3.47E-05	9.	2.98E-05	14.2	-5.34E-03	-1.17E-04	-1.16E-06
1174.96961	0.	2	1	1	2	0	2	1.01E-02	0.	1.01E-02	-5.	-9.85E-02	-2.24E-03	0.00E+00
1175.61648	-5.	3	3	0	4	2	3	1.33E-04	7.	1.34E-04	-8.	-1.13E-02	-3.10E-04	-1.94E-06
1177.53778	1.	6	3	3	5	4	2	4.43E-04	5.	4.26E-04	3.7	-2.01E-02	-5.00E-04	0.00E+00
1177.81222	5.	7	4	4	6	5	1	1.70E-04	2.	1.77E-04	-4.2	-1.30E-02	-3.45E-04	-1.40E-06
1178.07313	-33.	5	4	1	6	3	4	9.17E-05	8.	9.68E-05	-5.6	-9.53E-03	-3.06E-04	-3.54E-06
1178.17073	-2.	6	2	5	5	3	2	4.26E-04	3.	3.83E-04	10.0	-1.91E-02	-4.45E-04	3.86E-08
1178.41420	-20.	7	4	3	6	5	2	8.31E-05	15.	8.90E-05	-7.1	-9.19E-03	-2.44E-04	-9.85E-07
1180.39416	5.	3	1	2	3	0	3	4.78E-03	2.	4.60E-03	3.7	-6.63E-02	-1.52E-03	0.00E+00
1181.31056	3.	1	1	1	0	0	0	5.72E-03	2.	5.78E-03	-1.1	7.44E-02	1.68E-03	-1.18E-06
1181.58200	0.	9	2	8	8	3	5	1.68E-04	4.	1.42E-04	15.3	-1.17E-02	-2.64E-04	-1.40E-06
1182.31861	50.	7	5	2	8	4	5	3.61E-05	1.	3.64E-05	-9.	-5.81E-03	-2.25E-04	-4.70E-06
1182.73080	2.	5	2	3	4	3	2	4.93E-04	3.	4.82E-04	2.2	-2.14E-02	-5.06E-04	5.74E-07
1183.26410	26.	7	2	6	6	3	3	6.59E-04	3.	5.50E-04	16.6	-2.29E-02	-5.33E-04	-4.17E-07
1183.61133	-4.	8	5	4	7	6	1	3.98E-05	15.	3.24E-05	18.6	-5.53E-03	-1.59E-04	-1.40E-06
1185.79496	-2.	7	3	5	6	4	2	5.10E-04	1.	4.64E-04	9.0	-2.10E-02	-5.22E-04	0.00E+00
1185.98491	-3.	3	0	3	2	1	2	4.05E-03	1.	4.06E-03	-3.	-6.24E-02	-1.38E-03	2.73E-06
1188.53597	3.	4	1	3	4	0	4	7.10E-03	1.	6.83E-03	3.9	-8.07E-02	-1.87E-03	-3.99E-07
1188.79964	0.	4	1	3	3	2	2	2.65E-03	1.	2.59E-03	2.1	-4.98E-02	-1.14E-03	2.35E-06
1188.85727	-1.	4	4	1	5	3	2	4.97E-05	6.	5.52E-05	-11.0	-7.20E-03	-2.29E-04	-2.38E-06
1190.72598	-1.	3	2	1	3	1	2	3.77E-03	2.	3.61E-03	4.3	-5.87E-02	-1.40E-03	-7.56E-07
1191.94450	4.	5	2	3	5	1	4	4.04E-03	1.	3.79E-03	6.3	-6.01E-02	-1.44E-03	-3.33E-07
1192.21865	9.	8	4	4	7	5	3	1.94E-04	5.	1.98E-04	-2.2	-1.37E-02	-3.66E-04	-1.84E-06
1192.49716	1.	2	2	0	2	1	1	4.47E-03	0.	4.35E-03	2.6	-6.44E-02	-1.55E-03	-1.08E-06
1193.56623	2.	7	3	4	6	4	3	2.35E-04	6.	2.48E-04	-5.5	-1.54E-02	-3.86E-04	-4.21E-07
1194.91770	-10.	6	5	1	7	4	4	6.35E-05	2.	6.57E-05	-3.5	-7.80E-03	-3.04E-04	-5.75E-06
1196.31177	-6.	8	3	6	7	4	3	2.04E-04	4.	1.99E-04	2.7	-1.37E-02	-3.42E-04	0.00E+00
1196.34006	-8.	9	5	5	8	6	2	6.52E-05	2.	6.98E-05	-7.0	-8.12E-03	-2.32E-04	-2.56E-06
1196.55236	3.	6	2	4	6	1	5	5.95E-03	0.	5.51E-03	7.4	-7.25E-02	-1.75E-03	-1.20E-07
1196.62044	31.	9	5	4	8	6	3	3.25E-05	6.	3.49E-05	-7.5	-5.74E-03	-1.64E-04	-1.81E-06
1198.37875	2.	4	0	4	3	1	3	1.13E-02	2.	1.15E-02	-1.7	-1.05E-01	-2.34E-03	6.02E-06
1199.15350	3.	3	1	3	2	0	2	1.02E-02	0.	1.07E-02	-4.6	1.01E-01	2.28E-03	-4.86E-06
1199.23975	3.	5	1	4	5	0	5	2.48E-03	1.	2.27E-03	8.3	-4.66E-02	-1.10E-03	-3.49E-07
1199.68992	3.	2	2	1	2	1	2	1.68E-03	6.	1.61E-03	4.4	-3.91E-02	-9.50E-04	-9.25E-07
1200.82424	0.	6	2	4	5	3	3	1.30E-03	3.	1.24E-03	4.8	-3.44E-02	-8.28E-04	1.24E-06
1203.01382	-13.	9	4	6	8	5	3	1.88E-04	11.	1.72E-04	8.6	-1.28E-02	-3.39E-04	-2.20E-06
1203.81375	-2.	3	2	2	3	1	3	4.33E-03	1.	4.27E-03	1.4	-6.38E-02	-1.55E-03	-1.59E-06
1204.38065	3.	7	2	5	7	1	6	1.92E-03	1.	1.69E-03	12.0	-4.01E-02	-9.85E-04	1.61E-07
1204.93391	7.	9	3	7	8	4	4	2.86E-04	23.	2.74E-04	4.2	-1.62E-02	-4.01E-04	0.00E+00
1206.96480	3.	4	1	4	3	0	3	6.25E-03	0.	6.36E-03	-1.7	7.80E-02	1.75E-03	-4.88E-06
1207.10239	-37.	9	4	5	8	5	4	8.47E-05	6.	8.76E-05	-3.5	-9.12E-03	-2.44E-04	-1.49E-06
1209.84071	1.	5	0	5	4	1	4	6.57E-03	0.	6.65E-03	-1.2	-7.97E-02	-1.79E-03	5.71E-06

table 6 continued

observed position	o-c	upper			lower			observed strength	ts	computed		(o-c)‡	z1 ^a	z2 ^a	z3 ^a
		J	K _a	K _c	J	K _a	K _c			strength	strength				
1209.92777	4.	10	5	5	9	6	4	5.85E-05	5.	5.95E-05	-1.7	-7.50E-03	-2.13E-04	-2.89E-06	
1210.28673	11.	7	3	4	7	2	5	1.73E-03	2.	1.53E-03	11.8	-3.81E-02	-9.79E-04	-7.22E-07	
1210.42459	4.	8	3	5	8	2	6	2.44E-03	1.	2.16E-03	11.6	-4.53E-02	-1.17E-03	-1.94E-07	
1210.75974	29.	10	3	8	9	4	5	7.94E-05	10.	7.78E-05	2.0	-8.61E-03	-2.11E-04	-1.19E-06	
1211.44464	-3.	8	3	5	7	4	4	4.85E-04	2.	4.65E-04	4.1	-2.10E-02	-5.37E-04	-6.20E-07	
1211.73181	0.	6	1	5	6	0	6	3.26E-03	4.	2.95E-03	9.6	-5.30E-02	-1.26E-03	-4.37E-07	
1212.50372	0.	6	3	3	6	2	4	3.90E-03	0.	3.65E-03	6.4	-5.89E-02	-1.52E-03	-1.88E-06	
1212.91881	5.	11	3	9	10	4	6	8.71E-05	8.	7.35E-05	15.6	-8.37E-03	-2.00E-04	-1.78E-06	
1214.84657	-2.	5	1	5	4	0	4	1.31E-02	1.	1.38E-02	-5.3	1.15E-01	2.59E-03	-8.74E-06	
1215.25438	0.	8	2	6	8	1	7	2.17E-03	1.	1.88E-03	13.4	-4.23E-02	-1.05E-03	6.16E-07	
1215.89812	1.	5	3	2	5	2	3	2.05E-03	2.	1.91E-03	7.0	-4.25E-02	-1.11E-03	-1.84E-06	
1216.31465	-2.	5	2	4	5	1	5	3.56E-03	1.	3.46E-03	2.7	-5.74E-02	-1.40E-03	-1.44E-06	
1217.10065	20.	11	6	6	10	7	3	1.56E-05	15.	1.75E-05	-12.4	-4.06E-03	-1.22E-04	-3.56E-06	
1218.85716	20.	2	2	1	1	1	0	3.45E-03	1.	3.25E-03	5.7	5.57E-02	1.35E-03	-1.33E-06	
1219.22239	-3.	4	3	1	4	2	2	3.59E-03	1.	3.46E-03	3.7	-5.73E-02	-1.51E-03	-3.02E-06	
1219.83380	-9.	7	2	5	6	3	4	6.93E-04	4.	6.67E-04	3.8	-2.52E-02	-6.20E-04	1.22E-06	
1220.42586	-2.	6	0	6	5	1	5	1.32E-02	2.	1.34E-02	-1.4	-1.13E-01	-2.54E-03	9.73E-06	
1220.68198	0.	10	3	7	10	2	8	8.17E-04	14.	6.62E-04	18.9	-2.51E-02	-6.56E-04	1.09E-06	
1221.57197	-4.	3	3	0	3	2	1	1.24E-03	3.	1.17E-03	5.6	-3.33E-02	-8.88E-04	-1.97E-06	
1221.83746	2.	2	2	0	1	1	1	5.48E-03	2.	5.73E-03	-4.5	7.39E-02	1.80E-03	-1.69E-06	
1223.10928	-4.	6	1	6	5	0	5	6.73E-03	3.	6.82E-03	-1.3	8.07E-02	1.82E-03	-7.18E-06	
1223.53186	-8.	10	4	6	9	5	5	1.41E-04	9.	1.32E-04	6.5	-1.12E-02	-3.01E-04	-2.19E-06	
1223.70388	-6.	3	3	1	3	2	2	2.25E-03	2.	2.30E-03	-2.2	-4.67E-02	-1.25E-03	-2.88E-06	
1224.92128	1.	4	3	2	4	2	3	1.68E-03	3.	1.61E-03	4.0	-3.91E-02	-1.04E-03	-2.30E-06	
1225.84730	17.	11	4	8	10	5	5	9.10E-05	9.	8.01E-05	12.0	-8.72E-03	-2.28E-04	-2.36E-06	
1227.11933	1.	5	3	3	5	2	4	3.43E-03	1.	3.27E-03	4.8	-5.57E-02	-1.47E-03	-3.02E-06	
1228.41480	1.	9	2	7	9	1	8	5.50E-04	3.	5.00E-04	9.1	-2.18E-02	-5.48E-04	7.73E-07	
1228.47949	-1.	3	2	2	2	1	1	6.57E-03	1.	6.43E-03	2.1	7.83E-02	1.90E-03	-3.78E-06	
1231.01779	-2.	9	3	6	8	4	5	1.91E-04	8.	1.92E-04	-3.	-1.35E-02	-3.52E-04	-3.90E-07	
1231.72428	0.	7	1	7	6	0	6	1.21E-02	2.	1.23E-02	-1.9	1.09E-01	2.44E-03	-1.10E-05	
1232.40986	-7.	10	4	6	10	3	7	5.69E-04	4.	4.91E-04	13.7	-2.16E-02	-5.96E-04	-2.33E-07	
1233.66308	3.	7	2	6	7	1	7	1.86E-03	2.	1.80E-03	3.5	-4.14E-02	-1.01E-03	-4.95E-07	
1235.35462	7.	7	3	5	7	2	6	2.17E-03	1.	2.05E-03	5.3	-4.42E-02	-1.16E-03	-1.52E-06	
1237.00019	-7.	7	1	6	6	2	5	2.35E-03	1.	2.29E-03	2.8	-4.67E-02	-1.12E-03	4.48E-06	
1238.14196	-11.	8	1	7	8	0	8	1.23E-03	1.	1.20E-03	2.8	-3.38E-02	-8.15E-04	2.94E-07	
1238.20446	-45.	3	2	1	2	1	2	2.05E-03	2.	2.13E-03	-3.9	4.51E-02	1.11E-03	-2.21E-06	
1238.76195	7.	12	5	7	11	6	6	2.68E-05	7.	2.76E-05	-2.9	-5.11E-03	-1.40E-04	-2.70E-06	
1239.87030	1.	8	0	8	7	1	7	9.94E-03	2.	1.03E-02	-3.7	-9.93E-02	-2.22E-03	1.13E-05	
1240.53716	-12.	8	1	8	7	0	7	4.66E-03	3.	5.16E-03	-10.8	7.03E-02	1.58E-03	-8.06E-06	
1241.07735	7.	8	4	4	8	3	5	1.22E-03	4.	1.07E-03	12.4	-3.18E-02	-9.02E-04	-2.63E-06	
1241.58071	8.	8	3	6	8	2	7	7.38E-04	2.	6.88E-04	6.8	-2.56E-02	-6.69E-04	-3.54E-07	
1243.58601	5.	8	2	7	8	1	8	6.00E-04	3.	5.88E-04	2.1	-2.37E-02	-5.77E-04	1.15E-07	
1244.01018	-3.	5	2	4	4	1	3	6.16E-03	0.	6.11E-03	.9	7.63E-02	1.86E-03	-7.07E-06	
1244.32277	1.	12	3	9	12	2	10	1.65E-04	5.	1.35E-04	18.3	-1.13E-02	-2.96E-04	1.99E-06	
1248.77067	0.	6	4	2	6	3	3	1.75E-03	2.	1.64E-03	6.1	-3.94E-02	-1.16E-03	-4.88E-06	
1249.09280	2.	9	0	9	8	1	8	3.99E-03	0.	4.04E-03	-1.3	-6.22E-02	-1.39E-03	7.90E-06	
1249.14083	-6.	9	3	7	9	2	8	8.45E-04	4.	8.49E-04	-.5	-2.84E-02	-7.37E-04	5.49E-07	
1249.41326	0.	9	1	9	8	0	8	7.89E-03	0.	8.09E-03	-2.5	8.80E-02	1.97E-03	-1.12E-05	
1250.68916	-4.	5	4	1	5	3	2	8.94E-04	4.	8.28E-04	7.4	-2.79E-02	-8.37E-04	-3.77E-06	
1250.80199	-6.	9	1	8	9	0	9	3.76E-04	4.	3.68E-04	2.1	-1.87E-02	-4.51E-04	6.24E-07	
1250.97669	-4.	8	1	7	7	2	6	4.21E-03	0.	4.13E-03	1.8	-6.28E-02	-1.52E-03	7.22E-06	
1251.57720	-1.	4	4	0	4	3	1	1.28E-03	1.	1.21E-03	5.4	-3.38E-02	-1.02E-03	-4.76E-06	
1251.78876	1.	10	3	7	9	4	6	3.08E-04	5.	2.91E-04	5.6	-1.66E-02	-4.42E-04	-4.44E-07	
1251.92844	-15.	4	4	1	4	3	2	6.27E-04	3.	6.03E-04	3.8	-2.38E-02	-7.26E-04	-3.38E-06	
1252.00833	-1.	5	4	2	5	3	3	1.70E-03	2.	1.66E-03	2.6	-3.95E-02	-1.19E-03	-5.38E-06	
1253.23214	-29.	7	4	4	7	3	5	1.45E-03	3.	1.36E-03	6.5	-3.58E-02	-1.04E-03	-3.99E-06	
1254.00472	1.	9	2	8	9	1	9	7.41E-04	5.	7.33E-04	1.1	-2.64E-02	-6.39E-04	8.49E-07	
1254.94549	-10.	8	4	5	8	3	6	5.31E-04	2.	4.96E-04	6.5	-2.17E-02	-6.22E-04	-1.92E-06	
1256.71615	-3.	7	2	6	6	1	5	5.13E-03	1.	5.18E-03	-1.1	7.03E-02	1.72E-03	-8.73E-06	
1257.25924	-13.	11	2	9	11	1	10	1.44E-04	7.	1.38E-04	4.5	-1.14E-02	-2.84E-04	1.66E-06	
1257.76664	-6.	9	4	6	9	3	7	6.89E-04	5.	6.54E-04	5.0	-2.49E-02	-7.02E-04	-1.33E-06	
1257.83861	-2.	4	2	2	3	1	3	2.77E-03	1.	2.70E-03	2.5	5.07E-02	1.27E-03	-4.15E-06	
1257.85336	15.	10	3	8	10	2	9	2.46E-04	5.	2.45E-04	.4	-1.53E-02	-3.91E-04	1.09E-06	
1258.11574	3.	10	0	10	9	1	9	5.82E-03	1.	5.94E-03	-2.1	-7.54E-02	-1.68E-03	1.06E-05	
1258.13470	-6.	9	2	7	8	3	6	5.37E-04	8.	5.53E-04	-3.0	-2.29E-02	-5.89E-04	1.87E-06	
1258.26813	0.	10	1	10	9	0	9	2.97E-03	1.	2.98E-03	-.3	5.34E-02	1.19E-03	-7.50E-06	
1259.64345	1.	3	3	1	2	2	0	6.69E-03	0.	6.67E-03	.4	7.95E-02	2.15E-03	-2.85E-06	

table 6 continued

observed position	o-c	J K _a K _c	upper	lower	observed strength	%s	computed strength	(o-c)%	Z1 ^a	Z2 ^a	Z3 ^a
		J K _a K _c	J K _a K _c	J K _a K _c					Z1 ^a	Z2 ^a	Z3 ^a
1260.14395	5.	3 3 0	2 2 1	3.38E-03	1.	3.31E-03	2.0	5.60E-02	1.52E-03	-2.02E-06	
1261.89213	4.	10 4 7	10 3 8	2.21E-04	5.	1.96E-04	11.1	-1.36E-02	-3.77E-04	4.18E-10	
1262.02250	0.	12 4 8	11 5 7	5.02E-05	7.	5.49E-05	-9.3	-7.21E-03	-1.97E-04	0.00E+00	
1263.40215	3.	8 2 7	7 1 6	2.25E-03	2.	2.20E-03	2.0	4.58E-02	1.13E-03	-6.24E-06	
1263.57858	18.	9 1 8	8 2 7	1.78E-03	5.	1.68E-03	5.7	-4.00E-02	-9.77E-04	5.34E-06	
1264.71116	2.	10 2 9	10 1 10	2.02E-04	3.	2.20E-04	-8.9	-1.45E-02	-3.44E-04	1.05E-06	
1266.98411	2.	11 0 11	10 1 10	2.09E-03	2.	2.07E-03	1.0	-4.45E-02	-9.87E-04	6.82E-06	
1267.05590	-23.	11 1 11	10 0 10	4.42E-03	1.	4.13E-03	6.6	6.28E-02	1.40E-03	-9.65E-06	
1267.40857	-3.	11 4 8	11 3 9	2.45E-04	6.	2.17E-04	11.3	-1.44E-02	-3.86E-04	1.17E-06	
1267.47687	-10.	11 3 9	11 2 10	3.25E-04	25.	2.68E-04	17.6	-1.60E-02	-3.99E-04	2.42E-06	
1273.23638	-18.	10 5 5	10 4 6	2.40E-04	5.	2.30E-04	4.0	-1.47E-02	-4.43E-04	-1.87E-06	
1273.36695	2.	4 3 1	3 2 2	5.44E-03	1.	5.36E-03	1.5	7.13E-02	1.94E-03	-5.32E-06	
1275.06422	-31.	10 1 9	9 2 8	2.51E-03	2.	2.49E-03	.9	-4.87E-02	-1.19E-03	7.36E-06	
1275.72040	-2.	12 0 12	11 1 11	2.66E-03	0.	2.70E-03	-1.7	-5.09E-02	-1.12E-03	8.47E-06	
1276.09738	-13.	10 2 8	9 3 7	9.40E-04	2.	8.77E-04	6.7	-2.89E-02	-7.54E-04	2.85E-06	
1277.10386	-2.	9 5 4	9 4 5	2.08E-04	3.	1.81E-04	13.0	-1.30E-02	-4.09E-04	-2.62E-06	
1279.13143	0.	10 2 9	9 1 8	1.30E-03	2.	1.26E-03	3.1	3.46E-02	8.54E-04	-5.56E-06	
1279.55558	0.	8 5 3	8 4 4	5.38E-04	2.	5.17E-04	3.9	-2.20E-02	-7.16E-04	-5.43E-06	
1280.66287	1.	5 3 3	4 2 2	4.45E-03	0.	4.36E-03	2.1	6.43E-02	1.74E-03	-6.87E-06	
1281.22828	-4.	5 2 3	4 1 4	7.21E-04	3.	7.44E-04	-3.1	2.66E-02	6.83E-04	-3.39E-06	
1281.51177	-10.	8 5 4	8 4 5	2.65E-04	2.	2.60E-04	1.8	-1.56E-02	-5.11E-04	-3.94E-06	
1281.60188	-3.	9 5 5	9 4 6	3.89E-04	4.	3.66E-04	5.9	-1.85E-02	-5.85E-04	-3.78E-06	
1281.61441	-22.	7 5 3	7 4 4	6.83E-04	1.	6.55E-04	4.1	-2.48E-02	-8.26E-04	-6.47E-06	
1281.76246	4.	5 5 0	5 4 1	2.79E-04	6.	2.66E-04	4.6	-1.57E-02	-5.60E-04	-4.71E-06	
1282.12416	8.	10 5 6	10 4 7	1.27E-04	3.	1.17E-04	8.0	-1.05E-02	-3.18E-04	-1.32E-06	
1283.35535	7.	11 5 7	11 4 8	1.62E-04	12.	1.36E-04	16.3	-1.13E-02	-3.29E-04	2.73E-07	
1284.35264	-26.	13 1 13	12 0 12	1.64E-03	5.	1.68E-03	-2.5	4.01E-02	8.81E-04	-7.19E-06	
1285.56307	-24.	12 5 8	12 4 9	4.49E-05	20.	3.61E-05	19.7	-5.86E-03	-1.59E-04	1.13E-05	
1285.76300	1.	11 1 10	10 2 9	8.74E-04	1.	8.51E-04	2.6	-2.85E-02	-6.99E-04	4.79E-06	
1287.95206	-9.	11 2 10	10 1 9	1.73E-03	5.	1.71E-03	1.1	4.04E-02	9.95E-04	-7.01E-06	
1288.45436	0.	13 3 11	13 2 12	6.06E-05	3.	7.04E-05	-16.1	-8.21E-03	-1.84E-04	3.74E-06	
1292.53852	-7.	11 2 9	10 3 8	3.48E-04	5.	3.17E-04	8.9	-1.73E-02	-4.59E-04	1.98E-06	
1292.84536	0.	14 1 14	13 0 13	4.24E-04	4.	4.92E-04	-16.0	2.19E-02	2.71E-04	-2.92E-06	
1294.23436	0.	12 3 9	11 4 8	1.45E-04	7.	1.37E-04	5.3	-1.14E-02	-3.15E-04	-3.32E-07	
1295.94600	-3.	12 1 11	11 2 10	1.13E-03	2.	1.09E-03	3.4	-3.22E-02	-7.90E-04	5.94E-06	
1297.09852	0.	12 2 11	11 1 10	5.43E-04	6.	5.48E-04	-.9	2.28E-02	5.60E-04	-4.28E-06	
*1301.22948	-93.	15 1 15	14 0 14	7.24E-04	10.	8.01E-04	-10.7	2.84E-02	-9.44E-05	-4.87E-06	
1301.26219	0.	4 4 0	3 3 1	5.14E-03	0.	5.05E-03	1.8	6.89E-02	2.14E-03	-3.90E-06	
1305.27082	2.	9 3 7	8 2 6	1.39E-03	3.	1.41E-03	-1.7	3.66E-02	9.99E-04	-6.55E-06	
1305.79557	-40.	13 1 12	12 2 11	3.09E-04	6.	3.28E-04	-.3	-1.77E-02	-4.31E-04	3.55E-06	
1306.39503	-12.	13 2 12	12 1 11	6.26E-04	3.	6.59E-04	-5.2	2.51E-02	6.11E-04	-5.06E-06	
1308.07380	-94.	14 2 13	14 1 14	2.25E-05	20.	2.23E-05	.9	-4.38E-03	-3.42E-04	1.54E-06	
1308.34666	23.	6 2 4	5 1 5	6.92E-04	4.	7.57E-04	-9.4	2.68E-02	7.11E-04	-5.24E-06	
1309.12537	-30.	11 6 5	11 5 6	3.82E-05	12.	3.45E-05	9.7	-5.68E-03	-1.88E-04	-1.60E-06	
1309.92997	0.	10 3 8	9 2 7	5.24E-04	4.	5.07E-04	3.2	2.19E-02	5.98E-04	-3.90E-06	
1310.76804	-9.	10 6 4	10 5 5	1.15E-04	13.	1.15E-04	-.3	-1.03E-02	-3.59E-04	-4.18E-06	
1311.45527	0.	11 6 6	11 5 7	7.40E-05	6.	6.95E-05	6.0	-8.11E-03	-2.41E-04	7.25E-06	
1311.65670	-5.	9 6 3	9 5 4	8.74E-05	9.	8.58E-05	1.9	-8.93E-03	-3.24E-04	-4.35E-06	
1311.74550	-9.	10 6 5	10 5 6	5.63E-05	5.	5.75E-05	-2.1	-7.34E-03	-2.40E-04	-1.03E-06	
1312.01314	6.	9 6 4	9 5 5	1.63E-04	5.	1.72E-04	-5.3	-1.26E-02	-4.47E-04	-5.06E-06	
1312.07137	2.	8 6 2	8 5 3	2.22E-04	1.	2.28E-04	-2.5	-1.45E-02	-5.53E-04	-7.97E-06	
*1312.15828	144.	6 6 0	6 5 1	3.34E-04	2.	3.05E-04	8.6	-1.68E-02	-7.03E-04	-1.00E-05	
1312.18102	11.	8 6 3	8 5 4	1.12E-04	5.	1.14E-04	-2.0	-1.03E-02	-3.87E-04	-5.31E-06	
1312.19882	-29.	7 6 1	7 5 2	1.42E-04	8.	1.27E-04	10.7	-1.08E-02	-4.34E-04	-1.00E-05	
1312.22600	-8.	7 6 2	7 5 3	2.73E-04	4.	2.54E-04	6.8	-1.53E-02	-6.12E-04	-8.83E-06	
1313.36978	3.	5 4 2	4 3 1	4.07E-03	3.	3.92E-03	3.6	6.07E-02	1.88E-03	-6.73E-06	
1313.76044	-7.	5 4 1	4 3 2	2.01E-03	2.	1.96E-03	2.7	4.29E-02	1.33E-03	-4.82E-06	
1315.22179	-2.	11 3 9	10 2 8	7.92E-04	15.	6.91E-04	12.8	2.56E-02	6.96E-04	-4.40E-06	
1315.42397	-29.	14 1 13	13 2 12	3.61E-04	2.	3.65E-04	-1.2	-1.90E-02	-1.06E-04	-3.63E-06	
1321.58557	20.	12 3 10	11 2 9	2.15E-04	5.	2.20E-04	-2.5	1.45E-02	3.92E-04	-2.36E-06	
1324.21683	7.	7 3 4	6 2 5	7.30E-04	3.	7.51E-04	-2.9	2.67E-02	7.54E-04	-6.18E-06	
1324.96914	-2.	6 4 3	5 3 2	1.50E-03	2.	1.43E-03	4.4	3.67E-02	1.14E-03	-5.98E-06	
1326.49494	2.	6 4 2	5 3 3	2.94E-03	1.	2.87E-03	2.4	5.20E-02	1.62E-03	-8.76E-06	
1329.09497	-14.	13 3 11	12 2 10	2.61E-04	4.	2.63E-04	-.6	1.58E-02	4.25E-04	-2.35E-06	
1338.76479	9.	7 2 5	6 1 6	1.67E-04	5.	1.90E-04	-13.7	1.34E-02	3.67E-04	-4.04E-06	
1339.80960	-6.	7 4 3	6 3 4	1.00E-03	4.	9.82E-04	1.8	3.04E-02	9.46E-04	-6.88E-06	
*1342.38024	-34.	7 7 1	7 6 2	1.08E-04	5.	1.03E-04	5.0	-9.76E-03	-3.61E-04	-6.14E-06	

table 6 continued

observed position	o-c	upper J K _a K _c	lower J K _a K _c	observed strength	t _s	computed strength	(o-c)t	Z1 ^a	Z2 ^a	Z3 ^a
*1342.60939	319.	8 7 1	8 6 2	1.14E-04	14.	1.21E-04	-6.1	-1.08E-02	-1.89E-04	6.50E-06
1342.74221	-87.	9 7 3	9 6 4	6.04E-05	14.	6.63E-05	-9.7	-8.31E-03	1.50E-04	1.64E-05
*1343.56500	113.	5 5 1	4 4 0	4.50E-03	7.	4.51E-03	-.3	6.48E-02	2.37E-03	-5.89E-06
1347.62049	7.	8 3 5	7 2 6	7.53E-04	1.	7.65E-04	-1.6	2.69E-02	7.77E-04	-8.66E-06
1354.27467	2.	8 4 4	7 3 5	1.25E-03	1.	1.23E-03	1.4	3.41E-02	1.06E-03	-9.82E-06
1356.03093	26.	6 5 1	5 4 2	2.21E-03	2.	2.21E-03	-.1	4.54E-02	1.65E-03	-7.74E-06
1356.55680	84.	10 4 6	10 1 9	3.24E-05	14.	3.32E-05	-2.4	5.62E-03	1.41E-04	-2.41E-06
1368.46230	7.	7 5 2	6 4 3	7.41E-04	7.	7.75E-04	-4.5	2.69E-02	9.67E-04	-6.59E-06
1371.78372	32.	8 2 6	7 1 7	1.66E-04	14.	1.96E-04	-18.4	1.36E-02	3.85E-04	-6.33E-06
1380.09530	10.	8 5 4	7 4 3	5.04E-04	4.	5.09E-04	-1.0	2.18E-02	7.77E-04	-6.72E-06
1380.91252	-14.	8 5 3	7 4 4	9.69E-04	8.	1.02E-03	-5.4	3.09E-02	1.10E-03	-9.66E-06
*1386.31428	-92.	6 6 0	5 5 1	2.75E-03	15.	2.23E-03	18.8	4.53E-02	1.99E-03	-6.77E-06
1391.22031	6.	9 5 5	8 4 4	6.18E-04	2.	6.29E-04	-1.7	2.42E-02	8.53E-04	-8.46E-06
1393.53738	6.	9 5 4	8 4 5	3.44E-04	15.	3.16E-04	8.1	1.72E-02	6.08E-04	-6.34E-06
1398.86196	5.	7 6 2	6 5 1	1.03E-03	3.	1.04E-03	-1.5	3.10E-02	1.33E-03	-8.04E-06
1398.86684	0.	7 6 1	6 5 2	5.30E-04	4.	5.22E-04	1.5	2.19E-02	9.42E-04	-6.98E-06
1401.09967	-7.	10 5 6	9 4 5	1.73E-04	4.	1.82E-04	-5.1	1.30E-02	4.53E-04	-4.64E-06
1406.64634	-4.	10 5 5	9 4 6	3.47E-04	2.	3.67E-04	-5.8	1.85E-02	6.52E-04	-7.46E-06
1409.19956	3.	11 5 7	10 4 6	1.96E-04	3.	1.97E-04	-.4	1.36E-02	4.65E-04	-4.15E-06
1411.35171	-2.	8 6 2	7 5 3	6.14E-04	7.	6.94E-04	-13.1	2.53E-02	1.06E-03	-9.12E-06
1415.20735	10.	12 5 8	11 4 7	4.90E-05	4.	5.05E-05	-3.0	6.87E-03	2.33E-04	2.53E-06
1420.73650	-30.	11 5 6	10 4 7	9.40E-05	9.	9.87E-05	-5.0	9.59E-03	3.45E-04	-3.21E-06
1423.61959	-6.	9 6 4	8 5 3	3.98E-04	4.	4.38E-04	-10.0	2.01E-02	8.28E-04	-8.22E-06
1423.74265	-1.	9 6 3	8 5 4	1.95E-04	5.	2.19E-04	-12.1	1.42E-02	5.81E-04	-6.29E-06
*1428.97216	0.	7 7 1	6 6 0	8.34E-04	1.	9.66E-04	-15.9	2.95E-02	1.58E-03	-5.81E-06
1435.62933	13.	10 6 5	9 5 4	1.18E-04	8.	1.30E-04	-10.0	1.10E-02	4.40E-04	-4.32E-06
1436.03759	16.	10 6 4	9 5 5	2.33E-04	1.	2.60E-04	-11.7	1.55E-02	6.13E-04	-7.89E-06
1436.52344	3.	12 5 7	11 4 8	8.56E-05	8.	9.75E-05	-13.9	9.58E-03	3.04E-04	-6.87E-06
1448.28772	28.	11 6 5	10 5 6	6.18E-05	10.	7.29E-05	-17.9	8.23E-03	3.12E-04	-4.48E-06
1457.82533	-21.	12 6 7	11 5 6	3.19E-05	0.	3.76E-05	-17.9	5.92E-03	2.25E-04	-7.89E-06
1460.63126	0.	12 6 6	11 5 7	6.80E-05	4.	7.68E-05	-13.0	8.46E-03	3.07E-04	-4.51E-06

a. the computed strength = (Z1 + Z2 + Z3)² where Z1 is the contribution due to no interactions while Z2 and Z3 are due to interactions by the (100)-(010) and (001)-(010) bands, respectively.

positions in cm⁻¹

o-c, observed minus computed line positions × 10⁵. The computed values are derived from the energy levels given in Table 1

t_s are the estimated uncertainties in the measured line strengths in percent.

(o-c)t, observed minus computed line strength values given in percent. Computed value are derived from constants obtained in this work and given in Table 4.

*asterisks denote doubled absorptions with the quantum assignment given for the stronger transition.

The strength given represents the sum of the strengths of the two comparable transitions.

Strengths normalized to 99.9% D₂¹⁶O

Table 7. Line positions and strengths (cm⁻²/atm. at 296K) of the (100)-(010) band of D₂¹⁶O

observed position	o-c	upper J K _a K _c	lower J K _a K _c	observed strength	t _s	computed strength	(o-c)%	Z1 ^a	Z2 ^a	Z3 ^a
*1234.38870	-70.	6 6 0	7 7 1	2.50E-05	44.	2.86E-05	-14.4	-1.08E-02	5.95E-03	-5.27E-04
1292.61462	-10.	6 4 2	7 5 3	2.91E-05	20.	3.41E-05	-17.3	-1.18E-02	6.18E-03	-1.91E-04
*1319.19300	-49.	4 4 0	5 5 1	1.24E-04	3.	1.02E-04	18.1	-2.12E-02	1.13E-02	-1.09E-04
1323.27102	22.	6 3 3	7 4 4	3.12E-05	19.	3.71E-05	-19.0	-1.21E-02	6.15E-03	-1.18E-04
1332.94122	-27.	5 3 3	6 4 2	6.48E-05	4.	5.37E-05	17.1	-1.49E-02	7.67E-03	-1.03E-04
1351.88680	-24.	5 2 4	6 3 3	3.20E-05	4.	3.75E-05	-17.0	-1.25E-02	6.43E-03	-1.64E-05
1359.78785	18.	3 3 1	4 4 0	9.22E-05	14.	9.87E-05	-7.0	-2.07E-02	1.08E-02	-3.74E-05
1379.24980	-75.	6 4 2	6 5 1	2.31E-05	3.	1.97E-05	14.7	9.36E-03	-5.13E-03	2.09E-04
1394.68444	-3.	6 1 5	7 2 6	6.07E-05	9.	6.74E-05	-11.1	-1.54E-02	7.33E-03	-1.13E-04
1395.39903	17.	7 2 6	8 1 7	4.80E-05	4.	5.22E-05	-8.8	1.32E-02	-6.17E-03	2.07E-04
1396.93605	4.	8 0 8	9 1 9	7.34E-05	5.	7.65E-05	-4.3	-1.61E-02	7.67E-03	-2.98E-04
1397.13747	-28.	8 1 8	9 0 9	3.51E-05	4.	3.83E-05	-9.2	1.14E-02	-5.42E-03	2.13E-04
1398.60853	17.	2 2 1	3 3 0	5.29E-05	8.	5.58E-05	-5.5	-1.55E-02	7.99E-03	-5.87E-06
1399.12474	-21.	2 2 0	3 3 1	9.67E-05	1.	1.12E-04	-16.3	-2.19E-02	1.13E-02	-9.08E-06
1402.36163	-64.	5 1 4	6 2 5	3.74E-05	5.	3.86E-05	-3.1	-1.19E-02	5.72E-03	-5.48E-05
1404.51527	-3.	7 3 5	7 4 4	2.85E-05	23.	2.54E-05	11.0	1.14E-02	-6.02E-03	-3.48E-04
1407.05135	24.	7 0 7	8 1 8	5.25E-05	4.	5.17E-05	1.5	-1.33E-02	6.36E-03	-2.14E-04
1407.43746	-72.	5 3 3	5 4 2	4.45E-05	11.	3.92E-05	12.0	1.31E-02	-7.00E-03	1.44E-04
1407.49190	-2.	7 1 7	8 0 8	1.01E-04	7.	1.03E-04	-2.2	1.88E-02	-8.99E-03	3.09E-04
1409.88665	-33.	6 3 3	6 4 2	4.31E-05	11.	4.26E-05	1.2	1.34E-02	-7.01E-03	1.59E-04
1417.69454	0.	2 1 2	3 2 1	2.83E-05	10.	2.92E-05	-3.2	-1.11E-02	5.68E-03	1.83E-06
1417.95767	2.	6 1 6	7 0 7	6.59E-05	8.	6.44E-05	2.3	1.50E-02	-7.19E-03	2.13E-04
1425.12063	-35.	10 2 8	10 3 7	1.63E-05	19.	1.96E-05	-19.9	8.75E-03	-4.25E-03	-7.04E-05
1425.33946	8.	5 2 4	6 1 5	5.19E-05	13.	5.96E-05	-14.9	1.42E-02	-6.71E-03	2.17E-04
1427.08034	16.	2 1 1	3 2 2	8.80E-05	4.	9.40E-05	-6.8	-1.95E-02	9.81E-03	-7.54E-06
1435.96848	17.	4 0 4	5 1 5	1.60E-04	4.	1.59E-04	.7	-2.41E-02	1.17E-02	-2.03E-04
1437.15642	4.	1 1 0	2 2 1	5.89E-05	15.	4.87E-05	17.3	-1.42E-02	7.23E-03	0.00E+00
1438.33379	13.	4 2 2	4 3 1	6.90E-05	2.	7.15E-05	-3.6	1.74E-02	-8.97E-03	4.44E-05
1438.59985	-4.	5 1 5	5 2 4	5.95E-05	4.	6.02E-05	-1.2	1.64E-02	-8.65E-03	1.31E-05
1439.79409	-66.	4 1 4	5 0 5	7.83E-05	8.	7.69E-05	1.8	1.67E-02	-8.07E-03	1.72E-04
1440.60039	-35.	5 2 3	5 3 2	3.67E-05	11.	4.25E-05	-15.8	1.32E-02	-6.71E-03	3.70E-05
1441.85901	-64.	4 2 3	5 1 4	2.83E-05	12.	2.49E-05	11.8	9.22E-03	-4.37E-03	1.46E-04
1442.40432	19.	5 3 3	6 2 4	2.06E-05	40.	1.70E-05	17.5	6.99E-03	-3.21E-03	3.46E-04
1444.73680	-18.	3 0 3	4 1 4	7.52E-05	3.	7.69E-05	-2.3	-1.69E-02	8.27E-03	-9.87E-05
1445.37837	23.	7 1 6	7 2 5	3.09E-05	4.	3.63E-05	-17.5	1.21E-02	-6.03E-03	-2.41E-05
1451.60370	15.	3 1 3	4 0 4	1.41E-04	8.	1.40E-04	.5	2.26E-02	-1.10E-02	1.94E-04
1451.86708	-17.	3 1 3	3 2 2	7.03E-05	11.	7.09E-05	-.9	1.75E-02	-9.09E-03	-4.36E-06
1452.67339	-57.	5 0 5	5 1 4	4.27E-05	77.	3.92E-05	8.2	1.29E-02	-6.64E-03	-2.28E-05
1453.25333	-4.	2 0 2	3 1 3	1.43E-04	3.	1.35E-04	5.7	-2.27E-02	1.12E-02	-7.91E-05
1458.70771	-47.	3 2 2	4 1 3	3.11E-05	8.	3.39E-05	-9.1	1.08E-02	-5.12E-03	1.74E-04
1463.01929	-39.	2 1 1	2 2 0	7.48E-05	7.	7.42E-05	.8	1.75E-02	-8.92E-03	-1.22E-05
1463.66390	5.	4 0 4	4 1 3	1.05E-04	11.	1.11E-04	-5.3	2.15E-02	-1.09E-02	-4.89E-05
1464.02996	-16.	3 1 2	3 2 1	6.20E-05	4.	6.39E-05	-3.0	1.62E-02	-8.15E-03	-1.57E-05
1464.19763	-10.	2 1 2	3 0 3	5.03E-05	9.	5.14E-05	-2.3	1.38E-02	-6.71E-03	9.61E-05
1471.85288	61.	0 0 0	1 1 1	8.56E-05	15.	8.00E-05	6.5	-1.78E-02	8.89E-03	0.00E+00
1477.30933	7.	1 1 1	2 0 2	5.46E-05	18.	5.18E-05	5.1	1.39E-02	-6.77E-03	7.19E-05
1477.91909	-1.	2 0 2	2 1 1	1.68E-04	4.	1.52E-04	9.6	2.48E-02	-1.24E-02	-4.55E-05
1503.50487	-1.	1 1 0	1 0 1	6.47E-05	5.	6.05E-05	6.5	1.51E-02	-7.32E-03	0.00E+00
1506.03170	-13.	2 1 1	2 0 2	1.65E-04	7.	1.57E-04	4.9	2.41E-02	-1.16E-02	1.15E-06
1507.25894	-45.	2 0 2	1 1 1	5.93E-05	18.	5.44E-05	8.2	1.49E-02	-7.42E-03	-7.13E-05
1511.64666	-30.	8 2 6	9 1 9	2.19E-05	7.	2.36E-05	-.8.0	5.70E-06	-1.53E-04	5.01E-03
1513.22734	-12.	1 1 1	0 0 0	8.81E-05	12.	8.48E-05	3.7	-1.80E-02	8.76E-03	5.87E-05
1513.34833	0.	3 2 1	3 1 2	7.13E-05	13.	6.86E-05	3.7	1.55E-02	-7.29E-03	5.39E-05
1515.13994	-22.	8 3 5	8 2 6	6.32E-05	11.	6.23E-05	1.4	1.40E-02	-6.14E-03	3.27E-05
1515.93918	-9.	6 2 4	6 1 5	1.21E-04	8.	1.18E-04	2.3	1.99E-02	-9.09E-03	8.88E-06
1519.64883	-16.	3 0 3	2 1 2	6.37E-05	9.	5.66E-05	11.2	1.51E-02	-7.50E-03	-1.07E-04
1521.55133	15.	7 2 5	7 1 6	3.67E-05	12.	3.83E-05	-.4.3	1.13E-02	-5.08E-03	-4.64E-05
1526.32231	-35.	3 2 2	3 1 3	8.79E-05	4.	7.78E-05	11.4	1.64E-02	-7.64E-03	9.43E-05
1526.37335	-13.	5 1 4	5 0 5	4.39E-05	7.	4.17E-05	5.0	1.20E-02	-5.59E-03	1.11E-05
1526.93823	-1.	8 4 4	8 3 5	4.06E-05	8.	3.89E-05	4.1	1.05E-02	-4.55E-03	3.02E-04
1531.27829	-4.	4 0 4	3 1 3	1.62E-04	8.	1.59E-04	2.0	2.55E-02	-1.26E-02	-2.44E-04
1532.53231	-5.	5 1 4	4 2 3	3.01E-05	4.	2.87E-05	4.7	1.07E-02	-5.29E-03	-7.65E-05
1532.69810	-1.	3 3 1	3 2 2	5.41E-05	10.	5.12E-05	5.3	1.27E-02	-5.80E-03	2.24E-04
1532.79113	9.	10 5 5	10 4 6	1.08E-05	3.	9.19E-06	14.9	5.05E-03	-2.40E-03	3.79E-04
1534.41820	-10.	5 3 3	5 2 4	8.77E-05	7.	7.62E-05	13.2	1.55E-02	-7.01E-03	2.17E-04
1536.89689	21.	6 4 2	6 3 3	5.57E-05	7.	5.18E-05	7.0	1.20E-02	-5.29E-03	4.88E-04
1537.13362	14.	5 2 4	5 1 5	6.87E-05	16.	6.57E-05	4.4	1.49E-02	-6.91E-03	7.92E-05
1538.41216	-14.	4 1 4	3 0 3	9.02E-05	12.	8.89E-05	1.5	-1.88E-02	9.20E-03	2.17E-04
1539.90818	26.	5 4 1	5 3 2	2.25E-05	4.	2.51E-05	-11.4	8.31E-03	-3.67E-03	3.69E-04

table 7 continued

observed position	o-c	upper J K _a K _c	lower J K _a K _c	observed strength	%s	computed strength	(o-c)%	Z1 ^a	Z2 ^a	Z3 ^a
1541.26217	9.	5 4 2	5 3 3	4.16E-05	0.	4.96E-05	-19.2	1.16E-02	-5.14E-03	5.61E-04
1541.76650	-42.	4 4 0	4 3 1	4.21E-05	14.	3.56E-05	15.5	9.87E-03	-4.37E-03	4.62E-04
1544.91654	-25.	2 2 0	1 1 1	9.21E-05	7.	9.78E-05	-6.1	-1.87E-02	8.71E-03	1.14E-04
1546.02419	-5.	5 1 5	4 0 4	1.81E-04	2.	1.90E-04	-5.1	-2.77E-02	1.36E-02	3.75E-04
1546.05357	-8.	7 5 3	7 4 4	2.69E-05	16.	2.70E-05	-2.	7.80E-03	-3.45E-03	8.44E-04
1546.60133	-38.	6 1 5	5 2 4	7.73E-05	12.	7.25E-05	6.2	1.69E-02	-8.20E-03	-1.71E-04
1547.28884	1.	7 1 6	7 0 7	1.91E-05	2.	1.86E-05	2.5	7.97E-03	-3.66E-03	6.69E-06
1548.47296	-17.	8 6 2	8 5 3	1.80E-05	9.	1.52E-05	15.5	4.49E-03	-2.05E-03	1.46E-03
1550.82080	57.	7 6 2	7 5 3	2.23E-05	19.	1.93E-05	13.3	4.81E-03	-2.16E-03	1.75E-03
1550.98814	-25.	3 2 2	2 1 1	1.19E-04	9.	1.12E-04	6.1	-2.01E-02	9.36E-03	2.19E-04
1551.86050	-18.	6 0 6	5 1 5	1.98E-04	5.	1.81E-04	8.5	2.73E-02	-1.35E-02	-4.02E-04
1552.87231	-85.	6 6 0	6 5 1	2.18E-05	7.	1.81E-05	17.1	4.39E-03	-1.94E-03	1.80E-03
1553.98826	-5.	6 1 6	5 0 5	9.43E-05	5.	9.22E-05	2.2	-1.94E-02	9.54E-03	3.02E-04
1559.30797	-31.	7 1 6	6 2 5	3.58E-05	19.	3.82E-05	-6.6	1.22E-02	-5.87E-03	-1.62E-04
1560.82781	56.	3 2 1	2 1 2	3.37E-05	8.	3.48E-05	-3.4	-1.12E-02	5.17E-03	1.55E-04
1562.30269	-12.	7 1 7	6 0 6	1.52E-04	4.	1.64E-04	-7.7	-2.61E-02	1.28E-02	4.58E-04
1568.63764	3.	3 3 1	2 2 0	1.44E-04	7.	1.40E-04	2.6	-2.18E-02	9.71E-03	2.20E-04
1569.15039	22.	3 3 0	2 2 1	6.25E-05	5.	6.95E-05	-11.2	-1.53E-02	6.83E-03	1.59E-04
1570.33573	-2.	8 0 8	7 1 7	1.27E-04	3.	1.35E-04	-6.0	2.38E-02	-1.17E-02	-4.64E-04
1570.47760	-30.	8 1 7	7 2 6	6.82E-05	13.	6.95E-05	-1.9	1.65E-02	-7.85E-03	-2.69E-04
1570.83662	-57.	8 1 8	7 0 7	7.28E-05	1.	6.74E-05	7.5	-1.69E-02	8.31E-03	3.32E-04
1574.98103	2.	7 2 6	6 1 5	7.64E-05	5.	8.98E-05	-17.6	-1.84E-02	8.51E-03	3.70E-04
1579.13018	-43.	4 3 2	3 2 1	5.38E-05	12.	5.80E-05	-7.8	-1.41E-02	6.22E-03	2.69E-04
1579.80449	3.	4 2 2	3 1 3	4.71E-05	14.	4.19E-05	10.9	-1.24E-02	5.58E-03	3.16E-04
1582.60164	-67.	10 2 8	9 3 7	1.47E-05	4.	1.75E-05	-19.1	8.17E-03	-3.83E-03	-1.49E-04
1587.96155	-29.	5 3 3	4 2 2	8.64E-05	3.	9.28E-05	-7.4	-1.79E-02	7.82E-03	4.59E-04
1588.03207	-44.	10 0 10	9 1 9	8.12E-05	5.	7.42E-05	8.7	1.80E-02	-8.93E-03	-4.32E-04
1588.13945	-44.	10 1 10	9 0 9	3.58E-05	4.	3.74E-05	-4.4	-1.27E-02	6.31E-03	3.06E-04
1591.39943	22.	4 4 1	3 3 0	6.51E-05	3.	6.54E-05	-4.4	-1.45E-02	6.18E-03	2.59E-04
1591.45177	-13.	4 4 0	3 3 1	1.25E-04	10.	1.30E-04	-4.0	-2.05E-02	8.75E-03	3.71E-04
1594.77547	-7.	6 3 4	5 2 3	3.04E-05	11.	3.64E-05	-19.7	-1.12E-02	4.84E-03	3.11E-04
1595.47402	-24.	5 3 2	4 2 3	3.69E-05	7.	3.89E-05	-5.5	-1.17E-02	5.11E-03	4.00E-04
1596.79374	3.	11 1 11	10 0 10	4.91E-05	5.	5.01E-05	-2.0	-1.49E-02	7.43E-03	3.94E-04
1597.56836	-91.	11 1 10	10 2 9	1.10E-05	12.	1.32E-05	-19.6	7.40E-03	-3.59E-03	-1.77E-04
1600.59382	-30.	7 3 5	6 2 4	4.26E-05	12.	4.73E-05	-11.0	-1.31E-02	5.63E-03	5.70E-04
1602.62348	-1.	5 4 2	4 3 1	9.67E-05	3.	9.82E-05	-1.6	-1.82E-02	7.66E-03	5.93E-04
1602.97917	-6.	5 4 1	4 3 2	5.02E-05	10.	4.87E-05	2.9	-1.28E-02	5.41E-03	4.51E-04
1605.39263	-92.	12 0 12	11 1 11	2.89E-05	9.	3.18E-05	-10.0	1.20E-02	-6.02E-03	-3.45E-04
1605.50128	6.	12 1 11	11 2 10	1.76E-05	7.	1.73E-05	1.8	8.32E-03	-3.95E-03	-2.18E-04
1611.36368	-11.	6 3 3	5 2 4	4.30E-05	14.	4.75E-05	-10.5	-1.32E-02	5.65E-03	6.88E-04
1613.21989	58.	6 4 3	5 3 2	3.30E-05	28.	3.54E-05	-7.2	-1.10E-02	4.58E-03	4.69E-04
1613.99356	-24.	13 1 13	12 0 12	2.35E-05	9.	1.91E-05	18.9	-9.41E-03	4.75E-03	2.92E-04
1614.62063	-30.	6 4 2	5 3 3	6.21E-05	11.	6.84E-05	-10.2	-1.56E-02	6.50E-03	8.12E-04
1621.90938	-49.	6 5 2	5 4 1	3.74E-05	11.	3.02E-05	19.2	-1.04E-02	4.27E-03	6.75E-04
1621.95078	-33.	6 5 1	5 4 2	5.61E-05	2.	6.03E-05	-7.5	-1.48E-02	6.03E-03	9.66E-04
1626.78583	-78.	7 4 3	6 3 4	2.15E-05	6.	2.19E-05	-1.9	-9.07E-03	3.74E-03	6.44E-04
*1627.03097	-55.	6 6 0	5 5 1	6.61E-05	11.	6.08E-05	8.1	-1.56E-02	6.33E-03	1.43E-03
1632.67029	46.	7 5 3	6 4 2	3.34E-05	18.	3.83E-05	-14.7	-1.23E-02	5.03E-03	1.11E-03
1632.87454	30.	7 5 2	6 4 3	1.94E-05	25.	1.89E-05	2.7	-8.71E-03	3.55E-03	8.17E-04
1640.13566	5.	8 4 4	7 3 5	2.04E-05	19.	2.44E-05	-19.6	-9.99E-03	4.10E-03	9.57E-04
1643.71731	-79.	8 5 3	7 4 4	1.85E-05	2.	2.17E-05	-17.4	-9.95E-03	4.10E-03	1.20E-03
*1644.73084	-64.	7 7 1	6 6 0	6.12E-05	2.	5.88E-05	3.9	-9.27E-03	3.85E-03	-2.25E-03
*1655.05919	-30.	8 8 0	7 7 1	1.74E-05	8.	1.73E-05	.7	-6.68E-03	3.08E-03	-5.63E-04
*1657.77032	-40.	8 7 1	7 6 2	5.66E-05	4.	4.91E-05	13.2	-6.99E-03	2.93E-03	-2.95E-03
*1670.41770	-157.	9 7 3	8 6 2	3.54E-05	13.	3.65E-05	-3.1	-5.22E-03	2.22E-03	-3.04E-03

a. the computed strength = $(Z1 + Z2 + Z3)^2$ where Z1 is the contribution due to no interactions while Z2 and Z3 are due to interactions by the (020)-(010) and (001)-(010) bands, respectively.

positions in cm^{-1}

o-c, observed minus computed line positions $\times 10^5$. The computed values are derived from the energy levels given in Table 1

%s are the estimated uncertainties in the measured line strengths in percent.

(o-c)%, observed minus computed line strength values given in percent. Computed value are derived from constants obtained in this work and given in Table 4.

*asterisks denote doubled absorptions with the quantum assignment given for the stronger transition.

The strength given represents the sum of the strengths of the two comparable transitions.

Strengths normalized to 99.9% $D_2^{16}O$

Table 8. Line positions and strengths (cm⁻²/atm. at 296K) of the (001)-(010) band of D₂¹⁶O

observed position	o-c	upper J K _a K _c	lower J K _a K _c	observed strength	%s	computed strength	(o-c)%	Z1 ^a	Z2 ^a	Z3 ^a
1481.42998	-2.	7 4 3	8 4 4	2.00E-05	8.	1.77E-05	11.5	4.34E-03	-2.12E-04	8.26E-05
1495.25326	36.	6 4 3	7 4 4	2.73E-05	4.	2.71E-05	.8	5.30E-03	-1.54E-04	5.61E-05
1496.97271	13.	8 2 7	9 2 8	3.54E-05	4.	3.98E-05	-12.5	6.58E-03	-4.30E-04	1.60E-04
1503.07227	-34.	6 3 3	7 3 4	2.07E-05	10.	1.92E-05	7.3	4.47E-03	-1.45E-04	5.33E-05
1519.20830	0.	6 2 5	7 2 6	7.61E-05	6.	7.97E-05	-4.8	9.18E-03	-3.96E-04	1.44E-04
1523.57670	-1.	7 0 7	8 0 8	7.77E-05	7.	8.93E-05	-15.0	9.77E-03	-3.86E-04	6.50E-05
1524.28773	-11.	7 1 7	8 1 8	4.98E-05	0.	5.13E-05	-2.9	7.44E-03	-4.49E-04	1.66E-04
*1529.84189	27.	9 7 2	9 7 3	1.21E-05	1.	9.97E-06	17.6	3.00E-03	4.62E-04	-3.01E-04
1529.87843	-13.	5 1 4	6 1 5	1.13E-04	8.	1.02E-04	9.6	1.03E-02	-2.92E-04	1.01E-04
1531.03272	-4.	4 3 1	5 3 2	3.04E-05	4.	3.22E-05	-6.1	5.71E-03	-4.30E-05	1.14E-05
*1531.81613	-22.	8 7 2	8 7 1	1.94E-05	20.	1.93E-05	.5	4.28E-03	3.04E-04	-1.88E-04
1531.94200	-15.	4 3 2	5 3 3	6.80E-05	11.	6.67E-05	2.0	8.22E-03	-7.04E-05	1.89E-05
1541.83240	38.	4 1 3	5 1 4	7.79E-05	19.	6.31E-05	18.9	8.06E-03	-1.76E-04	6.61E-05
1544.13218	57.	5 0 5	6 0 6	1.91E-04	4.	1.65E-04	13.7	1.32E-02	-5.64E-04	2.09E-04
1544.28240	-2.	3 3 0	4 3 1	4.74E-05	9.	5.24E-05	-10.6	7.22E-03	3.59E-05	-2.17E-05
1544.57100	-45.	3 3 1	4 3 2	2.30E-05	6.	2.64E-05	-14.7	5.13E-03	2.36E-05	-1.48E-05
*1548.67825	-77.	7 6 1	7 6 2	4.20E-05	15.	4.43E-05	-5.4	5.77E-03	1.69E-03	-8.06E-04
1553.95680	-7.	3 2 2	4 2 3	5.39E-05	8.	5.83E-05	-8.1	7.69E-03	-8.92E-05	2.99E-05
1554.03926	7.	4 0 4	5 0 5	9.64E-05	7.	9.39E-05	2.5	9.90E-03	-3.27E-04	1.20E-04
1564.03943	-12.	3 0 3	4 0 4	1.91E-04	5.	1.97E-04	-3.1	1.42E-02	-3.38E-04	1.25E-04
1564.26899	23.	2 2 0	3 2 1	4.17E-05	5.	4.14E-05	.8	6.43E-03	1.03E-06	-3.10E-06
1564.76782	-1.	3 1 3	4 1 4	9.60E-05	5.	9.63E-05	-.3	9.96E-03	-2.35E-04	8.47E-05
1565.94591	27.	2 2 1	3 2 2	8.46E-05	2.	8.60E-05	-1.6	9.29E-03	-1.75E-05	0.00E+00
*1568.37932	-92.	5 5 0	5 5 1	1.66E-04	4.	1.64E-04	1.1	1.28E-02	-6.99E-05	3.48E-05
1568.68486	-2.	6 5 2	6 5 1	4.85E-05	2.	5.13E-05	-5.9	7.80E-03	-1.12E-03	4.80E-04
1568.69630	-40.	6 5 1	6 5 2	2.44E-05	8.	2.56E-05	-5.0	5.51E-03	-7.90E-04	3.39E-04
1574.40756	12.	2 0 2	3 0 3	9.28E-05	6.	9.41E-05	-1.4	9.79E-03	-1.46E-04	5.47E-05
1575.23015	-5.	2 1 2	3 1 3	1.65E-04	2.	1.73E-04	-4.7	1.33E-02	-1.95E-04	6.96E-05
1580.70937	17.	1 1 0	2 1 1	1.09E-04	6.	1.05E-04	3.7	1.02E-02	0.00E+00	0.00E+00
1581.04490	-49.	7 4 4	7 4 3	1.24E-05	10.	1.23E-05	1.0	4.01E-03	-8.71E-04	3.62E-04
1581.86902	-6.	6 4 3	6 4 2	5.12E-05	9.	5.11E-05	.2	7.76E-03	-1.05E-03	4.37E-04
1582.25585	-36.	5 4 2	5 4 1	5.13E-05	9.	4.91E-05	4.3	7.28E-03	-4.69E-04	1.96E-04
1582.36246	-18.	5 4 1	5 4 2	1.04E-04	9.	9.82E-05	5.6	1.03E-02	-6.63E-04	2.78E-04
1582.46402	-13.	4 4 1	4 4 0	1.56E-04	14.	1.79E-04	-15.0	1.34E-02	-4.79E-05	2.53E-05
1585.46100	-36.	1 0 1	2 0 2	1.31E-04	6.	1.55E-04	-18.1	1.25E-02	-8.60E-05	3.26E-05
1589.09609	6.	6 3 4	6 3 3	3.71E-05	15.	3.40E-05	8.4	6.36E-03	-8.96E-04	3.70E-04
1591.96816	-21.	5 3 3	5 3 2	3.39E-05	5.	3.53E-05	-4.3	6.24E-03	-5.14E-04	2.14E-04
1593.30353	-3.	4 3 2	4 3 1	1.29E-04	4.	1.32E-04	-2.4	1.17E-02	-4.36E-04	1.84E-04
1593.84918	14.	3 3 1	3 3 0	1.19E-04	2.	1.17E-04	1.8	1.08E-02	-1.69E-05	1.09E-05
1593.96771	31.	3 3 0	3 3 1	2.09E-04	7.	2.34E-04	-11.8	1.53E-02	-2.60E-05	1.60E-05
1594.99568	5.	5 3 2	5 3 3	7.91E-05	9.	7.37E-05	6.9	9.01E-03	-7.27E-04	2.99E-04
1595.70720	16.	4 2 3	4 2 2	6.46E-05	1.	5.99E-05	7.3	7.96E-03	-3.95E-04	1.70E-04
1597.21211	-10.	0 0 0	1 0 1	5.15E-05	0.	4.46E-05	13.4	6.68E-03	0.00E+00	0.00E+00
1597.37302	-9.	6 3 3	6 3 4	2.06E-05	6.	1.93E-05	6.3	4.75E-03	-6.07E-04	2.47E-04
1599.89591	-2.	2 1 2	2 1 1	6.84E-05	8.	5.81E-05	15.0	7.62E-03	-9.08E-06	1.15E-05
1599.91243	8.	3 2 2	3 2 1	6.04E-05	4.	5.96E-05	1.3	7.81E-03	-1.56E-04	6.88E-05
1601.89879	-12.	7 3 4	7 3 5	2.05E-05	2.	1.89E-05	7.6	4.86E-03	-8.44E-04	3.38E-04
1602.84054	-11.	2 2 0	2 2 1	1.18E-04	9.	1.14E-04	3.4	1.07E-02	-9.84E-07	0.00E+00
1604.45936	1.	3 2 1	3 2 2	1.24E-04	7.	1.25E-04	-1.2	1.14E-02	-2.69E-04	1.12E-04
1605.05511	-37.	1 1 1	1 1 0	8.17E-05	8.	6.57E-05	19.5	8.07E-03	4.96E-05	-1.69E-05
1608.13905	41.	4 2 2	4 2 3	3.43E-05	33.	3.50E-05	-2.0	6.11E-03	-3.26E-04	1.32E-04
1610.04941	-8.	1 1 0	1 1 1	1.37E-04	4.	1.39E-04	-1.5	1.18E-02	0.00E+00	0.00E+00
1614.19296	-28.	5 2 3	5 2 4	4.08E-05	11.	3.75E-05	8.1	6.46E-03	-5.55E-04	2.20E-04
1614.86487	-14.	2 1 1	2 1 2	3.11E-05	7.	3.49E-05	-12.1	5.97E-03	-1.01E-04	3.92E-05
1621.37952	-4.	1 0 1	0 0 0	1.00E-04	2.	1.05E-04	-5.4	1.02E-02	1.11E-04	-4.22E-05
1621.98198	-17.	3 1 2	3 1 3	4.55E-05	13.	4.03E-05	11.4	6.50E-03	-2.51E-04	9.54E-05
1629.23615	-7.	2 1 2	1 1 1	1.48E-04	3.	1.47E-04	.5	1.20E-02	2.85E-04	-1.08E-04
1632.82477	13.	2 0 2	1 0 1	1.05E-04	7.	1.02E-04	3.0	9.99E-03	1.61E-04	-6.03E-05
1634.03207	-1.	2 1 1	1 1 0	7.08E-05	3.	7.44E-05	-5.1	8.54E-03	1.45E-04	-5.59E-05
1638.48468	44.	3 2 2	2 2 1	6.32E-05	8.	6.68E-05	-5.7	7.97E-03	3.33E-04	-1.27E-04
1639.67977	-7.	3 1 3	2 1 2	1.23E-04	4.	1.21E-04	2.0	1.08E-02	3.33E-04	-1.24E-04
1640.39888	3.	3 2 1	2 2 0	1.32E-04	5.	1.34E-04	-1.6	1.13E-02	4.31E-04	-1.64E-04
1642.84332	8.	6 5 2	5 5 1	4.86E-05	8.	4.70E-05	3.2	5.07E-03	2.92E-03	-1.14E-03
1642.85006	21.	6 5 1	5 5 0	2.43E-05	8.	2.36E-05	3.0	3.59E-03	2.07E-03	-8.02E-04
1642.98826	-28.	4 3 2	3 3 1	1.08E-04	6.	1.00E-04	7.3	9.50E-03	8.15E-04	-3.08E-04
1643.25491	1.	3 0 3	2 0 2	2.67E-04	5.	2.76E-04	-3.2	1.64E-02	3.70E-04	-1.37E-04
1643.38161	-5.	4 3 1	3 3 0	5.58E-05	10.	5.00E-05	10.4	6.72E-03	5.67E-04	-2.14E-04
1644.06220	-64.	5 4 2	4 4 1	3.18E-05	4.	3.34E-05	-5.0	5.16E-03	9.97E-04	-3.77E-04
1644.12047	10.	5 4 1	4 4 0	6.22E-05	9.	6.67E-05	-7.3	7.29E-03	1.41E-03	-5.31E-04

table 8 continued

observed position	o-c	upper J K _a K _c	lower J K _a K _c	observed strength	%s	computed strength	(o-c)†	Z1 ^a	Z2 ^a	Z3 ^a
1646.64780	-8.	3 1 2	2 1 1	2.37E-04	5.	2.39E-04	-.8	1.53E-02	3.08E-04	-1.17E-04
1649.79071	10.	4 1 4	3 1 3	3.00E-04	3.	2.99E-04	.4	1.69E-02	6.43E-04	-2.38E-04
1649.85164	.9.	4 2 3	3 2 2	2.13E-04	6.	2.09E-04	1.9	1.40E-02	6.67E-04	-2.50E-04
1652.65673	-1.	4 0 4	3 0 3	1.50E-04	4.	1.59E-04	-6.1	1.24E-02	3.90E-04	-1.45E-04
1654.09409	-3.	4 2 2	3 2 1	9.94E-05	15.	1.03E-04	-4.0	9.92E-03	3.86E-04	-1.44E-04
1655.03941	-27.	5 3 3	4 3 2	6.90E-05	15.	7.44E-05	-7.9	8.16E-03	7.42E-04	-2.75E-04
1655.51451	-12.	7 5 3	6 5 2	2.90E-05	8.	2.97E-05	-2.3	4.09E-03	2.22E-03	-8.59E-04
1655.54994	-12.	7 5 2	6 5 1	5.85E-05	11.	5.94E-05	-1.6	5.79E-03	3.13E-03	-1.21E-03
1656.35692	-12.	5 3 2	4 3 1	1.58E-04	11.	1.48E-04	6.4	1.15E-02	9.93E-04	-3.67E-04
1656.36574	-3.	6 4 3	5 4 2	9.21E-05	11.	9.45E-05	-2.6	8.65E-03	1.71E-03	-6.36E-04
1658.54889	-8.	4 1 3	3 1 2	1.43E-04	7.	1.41E-04	1.4	1.17E-02	2.67E-04	-9.80E-05
1659.57881	-4.	5 1 5	4 1 4	1.60E-04	9.	1.60E-04	.1	1.23E-02	5.63E-04	-2.08E-04
1660.75346	-14.	5 2 4	4 2 3	1.20E-04	2.	1.20E-04	.3	1.06E-02	5.65E-04	-2.08E-04
1661.49691	-6.	5 0 5	4 0 4	3.33E-04	3.	3.29E-04	1.1	1.77E-02	7.76E-04	-2.91E-04
1666.82022	-6.	6 3 4	5 3 3	1.58E-04	6.	1.60E-04	-1.1	1.19E-02	1.14E-03	-4.15E-04
1667.73674	-4.	5 2 3	4 2 2	2.30E-04	4.	2.30E-04	.1	1.48E-02	5.72E-04	-2.09E-04
1668.08695	-14.	8 5 4	7 5 3	5.00E-05	13.	5.42E-05	-8.4	5.61E-03	2.84E-03	-1.10E-03
1668.21674	-75.	8 5 3	7 5 2	2.88E-05	0.	2.71E-05	6.0	3.97E-03	1.99E-03	-7.68E-04
1669.10925	5.	6 1 6	5 1 5	3.08E-04	5.	3.10E-04	-.8	1.70E-02	9.35E-04	-3.45E-04
1669.98870	-15.	6 3 3	5 3 2	8.26E-05	15.	7.79E-05	5.7	8.38E-03	7.01E-04	-2.53E-04
1670.31412	-24.	6 0 6	5 0 5	1.56E-04	4.	1.57E-04	-.7	1.20E-02	8.07E-04	-3.13E-04
1671.12541	-13.	6 2 5	5 2 4	2.13E-04	8.	2.35E-04	-10.3	1.48E-02	8.84E-04	-3.21E-04
1678.16999	-3.	7 3 5	6 3 4	7.07E-05	2.	7.31E-05	-3.5	8.04E-03	8.03E-04	-2.88E-04
1678.38754	-6.	7 0 7	6 0 6	2.17E-04	7.	2.19E-04	-1.1	1.49E-02	3.45E-04	2.25E-04
1678.48796	-12.	7 1 7	6 1 6	1.34E-04	6.	1.39E-04	-3.9	1.13E-02	7.80E-04	-2.92E-04
1678.75859	-3.	6 1 5	5 1 4	1.19E-04	3.	1.24E-04	-4.1	1.10E-02	1.66E-04	-3.59E-05
1680.91310	-14.	9 5 4	8 5 3	4.60E-05	7.	4.15E-05	9.7	5.03E-03	2.30E-03	-8.83E-04
1680.95389	-6.	7 2 6	6 2 5	1.03E-04	5.	1.04E-04	-.9	9.77E-03	6.64E-04	-2.39E-04
1684.12452	-26.	7 3 4	6 3 3	1.53E-04	9.	1.37E-04	10.6	1.11E-02	8.65E-04	-3.04E-04
1687.71404	-11.	8 0 8	7 0 7	1.17E-04	1.	1.11E-04	5.0	1.02E-02	4.37E-04	-1.39E-04
1688.72286	-3.	8 1 8	7 1 7	1.82E-04	7.	1.87E-04	-2.6	1.23E-02	2.34E-03	-9.64E-04
1688.95874	-10.	8 3 6	7 3 5	1.16E-04	2.	1.20E-04	-3.3	1.02E-02	1.08E-03	-3.83E-04
1690.29844	8.	8 2 7	7 2 6	1.86E-04	6.	1.70E-04	8.5	1.24E-02	9.92E-04	-3.58E-04
1692.39539	-65.	9 4 6	8 4 5	2.73E-05	7.	3.07E-05	-12.3	4.92E-03	9.66E-04	-3.48E-04
1692.44086	-16.	7 2 5	6 2 4	1.82E-04	4.	1.76E-04	3.5	1.29E-02	4.97E-04	-1.68E-04
1696.74197	-26.	9 0 9	8 0 8	1.73E-04	3.	1.77E-04	-2.2	1.28E-02	7.38E-04	-2.49E-04
1699.35809	2.	9 2 8	8 2 7	6.12E-05	13.	6.48E-05	-5.8	7.54E-03	8.00E-04	-2.96E-04
1701.34790	-25.	9 1 8	8 1 7	1.13E-04	13.	1.23E-04	-8.7	1.09E-02	2.64E-04	-4.35E-05
1702.72192	-46.	8 2 6	7 2 5	6.44E-05	4.	6.56E-05	-1.9	7.89E-03	3.02E-04	-9.53E-05
1705.68313	-8.	10 1 10	9 1 9	1.33E-04	7.	1.30E-04	2.5	1.09E-02	7.26E-04	-2.49E-04
1705.76647	-43.	10 0 10	9 0 9	6.72E-05	9.	6.53E-05	2.9	7.73E-03	5.25E-04	-1.81E-04
1706.89869	-51.	11 5 6	10 5 5	1.43E-05	4.	1.71E-05	-19.8	3.41E-03	1.19E-03	-4.54E-04
1711.27977	30.	9 2 7	8 2 6	1.12E-04	17.	9.19E-05	18.0	9.33E-03	3.48E-04	-9.64E-05
1714.31200	40.	11 4 8	10 4 7	1.63E-05	5.	1.34E-05	17.8	3.24E-03	6.55E-04	-2.35E-04
1714.75029	-44.	11 1 11	10 1 10	4.24E-05	3.	4.54E-05	-7.1	6.42E-03	4.89E-04	-1.69E-04
1714.78792	-11.	11 0 11	10 0 10	9.01E-05	7.	9.10E-05	-1.0	9.08E-03	6.96E-04	-2.40E-04
1716.21887	-41.	11 1 10	10 1 9	4.98E-05	8.	5.88E-05	-18.2	7.40E-03	3.49E-04	-7.44E-05
1718.19356	-7.	10 2 8	9 2 7	2.69E-05	8.	3.04E-05	-13.0	5.37E-03	1.91E-04	-4.27E-05
1722.95378	-14.	10 3 7	9 3 6	2.34E-05	1.	2.25E-05	4.0	4.55E-03	2.73E-04	-8.22E-05
1723.78093	-4.	12 1 12	11 1 11	5.84E-05	5.	5.99E-05	-2.5	7.33E-03	6.19E-04	-2.15E-04
1723.79826	93.	12 0 12	11 0 11	3.00E-05	6.	3.01E-05	-.2	5.19E-03	4.38E-04	-1.42E-04
1724.01599	26.	11 2 9	10 2 8	3.36E-05	6.	3.83E-05	-14.1	6.02E-03	2.11E-04	-3.58E-05
1725.07447	-54.	11 4 7	10 4 6	2.38E-05	18.	2.10E-05	11.6	4.24E-03	5.07E-04	-1.63E-04
1731.66737	-59.	13 1 12	12 1 11	2.64E-05	1.	2.23E-05	15.4	4.52E-03	2.98E-04	-8.76E-05

a. the computed strength = $(Z1 + Z2 + Z3)^2$ where Z1 is the contribution due to no interactions while Z2 and Z3 are due to interactions by the (100)-(010) and (020)-(010) bands, respectively.

positions in cm⁻¹

o-c, observed minus computed line positions $\times 10^5$. The computed values are derived from the energy levels given in Table 1

†s are the estimated uncertainties in the measured line strengths in percent.

(o-c)†, observed minus computed line strength values given in percent. Computed value are derived from constants obtained in this work and given in Table 4.

*asterisks denote doubled absorptions with the quantum assignment given for the stronger transition.

The strength given represents the sum of the strengths of the two comparable transitions.

Strengths normalized to 99.9% D₂¹⁶O